DELTA-MENDOTA CANAL UNIT

ENVIRONMENTAL ASSESSMENT
LONG-TERM CONTRACT RENEWAL

Affected Environment, Environmental Consequences, and Environmental Commitments

October 2000

Chapter 4
AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND ENVIRONMENTAL COMMITMENTS

INTRODUCTION

The Delta-Mendota Canal is part of the Delta Division of the CVP. The Delta Division provides for the transport of water through the central portion of the Central Valley and acts as a hub around which the CVP revolves. The Delta Division contains the facilities that transfer water from the Sacramento River to bolster irrigation supplies to lands formerly dependent on water from the San Joaquin River. The Delta Division facilities provide for the transport of water through both the Sacramento-San Joaquin River and the San Francisco Bay-Delta Estuary and for the delivery of water to CVP contractors in both the San Joaquin Valley and eastern Contra Costa County.

The subject of this EA is those water service contract deliveries to facilities (including the Delta-Mendota Canal) that transport water through the Sacramento-San Joaquin River to contractors in the San Joaquin Valley. The Contra Costa County facilities are included in a separate environmental review.

This chapter analyses impacts resulting from the implementation of Alternatives 1 and 2 when compared to the No-Action Alternative. The provisions of these alternatives are compared in Table 2-1 of this EA. Alternatives 1 and 2 are two “bookends” that represent a reasonable range of alternatives for long-term contract renewals. It is anticipated that the proposed action will represent a compromise with environmental consequences falling between the consequences of Alternatives 1 and 2, when compared to the No-Action Alternative. Mitigation is discussed only as appropriate, if impacts expected to result from the implementation of Alternative 1 or 2 could be avoided or reduced through such mitigation.

This chapter does not analyze impacts for which it would not be reasonable to assume that significant impacts could occur. Specifically, potential impacts to transportation, noise, hazards and hazardous materials, public services, utilities, and service systems are not analyzed, because it would not be reasonable to assume that the action of renewing long-term water service contracts could result in substantial impacts to these resources and services.

SECTION 4.1: CONTRACTOR SERVICE AREA DESCRIPTIONS

The project area for this EA is shown on Figure 4.1-1. Twenty contractors receive CVP water from the Delta-Mendota Canal and are included in this document. This area includes portions of Merced, Fresno, San Joaquin, and Stanislaus Counties. Specifically, the project area includes the service areas of the following irrigation districts, water districts, and other contractors:

- Banta-Carbona Irrigation District
- Broadview Water District
- Centinella Water District
- City of Tracy
- Coehlo Family Trust property
- Del Puerto Water District
- Eagle Field Water District
- Fresno Slough Water District
- James Irrigation District
- Laguna Water District
- Mardelia Hughes Property
- Mercy Springs Water District
- Oro Loma Water District
- Patterson Irrigation District
- Plain View Water District
- Reclamation District #1606
- The West Side Irrigation District
- Tranquillity Irrigation District
- West Stanislaus Water District
- Widren Water District

AFFECTED ENVIRONMENT

DESCRIPTION OF EXISTING DELTA-MENDOTA CANAL UNIT FACILITIES

Controlled releases of water from Shasta Reservoir are transported down the Sacramento River to the Sacramento-San Joaquin Delta. The Delta Cross Channel then transfers this CVP water to the Tracy Pumping Plant in the southern end of the Delta. The Tracy Pumping Plant lifts the water into the Delta-Mendota Canal, which delivers water to the CVP contractors. The CVP water also can be conveyed to the San Luis Reservoir for deliveries to CVP contractors that divert from the San Luis Canal. This latter use is described in detail in the Draft EIS for the San Luis Unit that is under development and will be available under separate cover. The following discussion describes the primary facilities of the Delta-Mendota Canal Unit of the Delta Division.

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Delta Cross Channel

The Delta Cross Channel is a 1.2-mile-long, controlled diversion channel between the Sacramento River and Mokelumne River. At the north end of the Sacramento-San Joaquin Delta, the Delta Cross Channel combines with several natural channels that carry the water approximately 50 miles to the Tracy Pumping Plant. Reclamation believes that the Delta Cross Channel and the training works in the San Joaquin River were necessary to prevent lesser quality water in the San Joaquin River from getting into the Tracy Pumping Plant.

To combat saltwater intrusion in the Delta and to dilute local pollution, the Delta Cross Channel draws fresh water from the Sacramento River to the Mokelumne River. The diversion also provides an adequate supply of water to the Delta-Mendota Canal and improves irrigation supplies in the Sacramento-San Joaquin Delta. During high water, Reclamation closes the control gates of the channel to prevent flood stages in the San Joaquin section of the Delta. Gates are reopened after flood danger passes to allow Sacramento River water through to the Tracy Pumping Plant. The Cross Channel is also operated to improve conditions for outmigrating chinook salmon and steelhead trout.

Tracy Pumping Plant

Construction of the Tracy Pumping Plant, which consists of an inlet channel, pumping plant and discharge pipes, was completed in 1951. Water received from the Sacramento-San Joaquin Delta is lifted 197 feet, pumped through discharge pipes, and carried approximately one mile up an inclined grade to the Delta-Mendota Canal. The power to run the pumps is supplied by CVP powerplants. The Delta-Mendota Intake Channel, an earth-lined section approximately 2.5 miles long, also includes a fish screen that was built to intercept downstream migrant fish so that they may be returned to the main channel to resume their journey to the ocean.

Delta-Mendota Canal

The Delta-Mendota Canal, the second largest of the CVP waterways, was completed in 1951. It includes a combination of both concrete-lined and earth-lined sections and is about 117 miles in length. It carries water southeasterly from the Tracy Pumping Plant along the west side of the San Joaquin Valley for irrigation supply, for use in the Delta-Mendota Canal Unit, and to replace San Joaquin River water stored by Friant Dam and used in the Friant-Kern and Madera Canals. The canal transports water from the Tracy Pumping Plant to the Mendota Pool, which is controlled by a concrete storage dam that was constructed in 1919. The Mendota Pool is located at the confluence of the San Joaquin River and the north fork of the Kings River, approximately 30 miles west of the city of Fresno.

DELTA-MENDOTA CANAL UNIT CONTRACTORS' FACILITIES AND WATER USE

Twenty contractors receive an allocation of CVP water from the Delta-Mendota Canal. A general description of each of these contractors and a discussion of both the CVP and other available water supplies to the contractor are provided below.

Banta-Carbona Irrigation District's Facilities and Water Use

Because low rainfall conditions have created potential dry-farming crop failures, farmers and landowners wanting to remain in business banded together and organized the Banta-Carbona Irrigation District, which was officially formed on March 14, 1921. The district was originally about 15,500 acres in size with no irrigated acres and is currently about 17,920 acres in size with 16,500 irrigated acres. The district is located in San Joaquin County just south of the city of Tracy and is adjacent to the Del Puerto Water District to the southwest and the West Stanislaus Water District to the southeast. Figures 4.1-2 and 4.1-3 show the current land uses and habitat types for the Banta-Carbona Irrigation District service area.

The distribution system in Banta-Carbona Irrigation District consists of 4 miles of unlined canal, 33.2 miles of concrete-lined canal, 46 miles of underground pipeline, and 4 miles of other unlined conveyance. CVP water is lifted from the Delta-Mendota Canal through two turnouts and is then distributed through a pipeline connected to the Banta-Carbona Main Lift Canal. All of the district's facilities are either pump or gravity delivery canals. Currently, all gates within the district are manually operated and all the turnouts are measured on a daily basis.

Use of CVP Water. On February 14, 1969, Banta-Carbona Irrigation District entered into a long-term contract (Contract 14-06-200-4305A) with Reclamation for 25,000 acre-feet of CVP supply. The contract expired on February 28, 1995. Since then, a series of interim contracts have been executed. The most recent interim contract (Contract 14-06-200-4305A-IR3) was executed on February 29, 2000.

Use of Other Available Water Supplies. The district also receives water supply from the Sacramento-San Joaquin Delta. This supply was originally a very dependable, high quality water source that has gradually degraded as more permits for water rights were granted and the water supply ran short to meet the new diversion quantities. The quality and reliability of Delta water has continued to worsen. Water from the Sacramento-San Joaquin Delta and CVP water are the only water supplies available to the district.

Operating Rules and Regulations. District policy requires all landowners to have either tailwater pumpback systems to recycle their tailwater or ponds to settle silt before the water is drained back into a district lateral for reuse. As a result, the Banta-Carbona Irrigation District's system is closed and no water escapes the district.

Banta-Carbona Irrigation District is also active in water transfers and has transferred water to The West Side Irrigation District, West Stanislaus Irrigation District, Panoche Water District, Broadview Water District, and Westlands Water District. Banta-Carbona Irrigation District has also informed Reclamation that it intends to transfer a portion of its CVP supply to the City of Tracy by 2025.

Broadview Water District's Facilities and Water Use

Originally a part of Westlands Water District, a group of landowners and farmers pulled out and formed Broadview Water District on August 16, 1955. Broadview Water District is located on the west side of the San Joaquin Valley and approximately five miles west of Firebaugh, in Fresno County. The district is approximately 9,515 acres in size with 9,300 irrigated acres. All of the land in the district is high quality production land. There is no marginal agricultural land in the district. Figures 4.1-4 and 4.1-5 show the current land uses and habitat types for the Broadview Water District service area.

Originally, the distribution system in Broadview Water District consisted of a single pipeline that connected to the Delta-Mendota Canal and ran two miles to the district boundaries. A series of six lift pumps and six booster pumps were later constructed to lift and distribute the water within the district service area. Later, in the 1960s, the distribution system was reconstructed to increase the capacity. Currently, the Broadview Water District's distribution system consists of 30 miles of open unlined canals and laterals, two miles of pipeline, and six pumping stations with a total of 36 pumps. All the water is lifted from the Delta-Mendota Canal into the district's main canal delivery system. The only storage facility in the Broadview Water District is the main canal, which consists of six pumping stations and five ponds. All the laterals from the main canal are gravity-fed. The main canal is automated and all of the laterals have manual gates. All turnouts on the system are metered.

Use of CVP Water. On November 27, 1959, Broadview Water District entered into a long-term contract (Contract 14-006-200-8092) with Reclamation for 16,000 acre-feet of CVP water. In May 1964, after the capacity of the district's distribution system was increased, the 1959 contract was amended. Under the new contract (Contract 14-06-200-8092 Amendatory), Reclamation would provide 27,000 acre-feet of CVP water to the district. The amended contract expired on February 28, 1995. Since then, a series of interim contracts have been executed.

A small portion of the CVP water is used for M&I use to provide drinking water in the district. This water is delivered through the San Luis Canal through the Westlands Water

District distribution system. Broadview Water District then receives the water through a turnout from the Westlands system.

Use of Other Available Water Supplies. CVP water is the only water supply source for the district. There is one groundwater well located in the district, but it is inoperable.

Operating Rules and Regulations. The district has drainage problems caused by impervious clay layers that restrict the downward movement of shallow groundwater containing salts and boron. As a result, a subsurface drainage system has been installed. The drainage system has 18 miles of open drain channels, 2.1 miles of pipeline, and three lift stations with nine pumps. There are also 25 tile drain systems that are owned by landowners. Water users recycle their drainage water with surface irrigation water and reapply it to their fields. Also, the district has historically drained discharge water through the Grassland Water District and into the San Joaquin River. Currently, as part of the Grasslands Bypass Project, Broadview Water District is required to remove its drainage water from the Grasslands Channels and convey the water through the existing San Luis Drain and into the San Joaquin River at the same point.[1]

As part of a land management program to reduce drain water and improve wildlife habitat, Broadview Water District is evaluating alternative crop rotation options for reducing volumes of drainage water. As part of the study, drains will be monitored and cropping patterns and irrigation management changes imposed based on the results. The program has been implemented through the use of a Reclamation grant.

Broadview Water District is active transferring water to other districts. Because many water users farm in both Broadview Water District and another districts, it is the district's policy to allow water users to transfer any portion of their allocation to their water accounts in other districts, provided the transfer does not significantly impact Broadview Water District operations.

Centinella Water District's Facilities and Water Use

Formed in 1964, Centinella Water District is located on the northern end of the San Luis Reservoir in Merced County and is adjacent to Del Puerto Water District to the north and east. The district is approximately 850 acres in size with 840 irrigated acres. Because of its small size, the district is exempt from Section 3405(e) of the CVPIA, which requires the preparation of a water conservation plan. Figures 4.1-6 and 4.1-7 show the current land uses and habitat types for the Centinella Water District service area.

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[1] The primary goals of the Grasslands Bypass Project are to remove the unusable agricultural drainage water from water delivery channels and ditches in the Grassland Water District and to provide an opportunity to collect the drainage water from a large agricultural area and place it in a single conveyance facility for transport to the San Joaquin River.

The district receives its CVP supply directly through a turnout on the Delta-Mendota Canal. This district does not have any distribution facilities and does not own any pumps, pipelines, or canals to transport the CVP supply. All turnouts, pumps, pipelines, and canals in the district are privately owned, maintained, and operated. All drainage systems are also privately developed, operated and maintained by individual landowners.

Use of CVP Water. The district operated under a temporary contract with Reclamation until a permanent cost-of-service type contract was executed. On July 8, 1977, Centinella Water District signed a long-term contract (Contract 7-07-20-W0055) with Reclamation to supply 2,500 acre-feet of CVP water. The contract expired on February 28, 1995. Since then, a series of interim contracts have been executed. The most recent interim contract (Contract 7-07-20-W0055-IR3) was executed on February 29, 2000.

Use of Other Available Water Supplies. CVP water is the only water supply source for the district.

Operating Rules and Regulations. Because all the distribution and drainage systems are owned, operated, and maintained by individual water users, the district has not instituted a drainage policy. The district, however, maintains a cooperative stance with downslope districts regarding problems arising from tailwater leaving district boundaries and will take necessary actions to remedy such problems.

The district’s policy on water transfers is to allow transfers of allocated water supply between parcels of land, either within the district or between districts, when the supply is associated with lands owned by the same landowner. Therefore, the only water transfers outside the district are transfers from a landowner to itself.

City of Tracy’s Facilities and Water Use

The city of Tracy is located in the central San Joaquin Valley, strategically placed at the juncture of Interstate 5 and Interstate 580, providing fast and easy access to both the San Francisco Bay Area and up and down the Central Valley. Tracy is a rapidly changing community with a population of nearly 48,000. One of seven cities in San Joaquin County, Tracy is also one of the fastest growing cities in the county. Its population is expected to grow to approximately 85,000 by the year 2010. Figures 4.1-8 and 4.1-9 show the current land uses and habitat types for the City of Tracy service area.

The City of Tracy receives its CVP supply from a turnout on the Delta-Mendota Canal. In 1999, about 56 percent of Tracy's water supply was provided by its CVP supply. Because the CVP water is used for M&I purposes, it must be treated before delivery. The treatment process for the CVP supply consists of chemical oxidation, coagulation, flocculation, filtration, and chlorination. In addition, chloramines (the combination of chlorine and a small amount of ammonia) are used as the residual disinfectant in the water distribution system. The CVP water is transferred by pipeline to the water treatment plant and, after treatment, transferred by pipeline to M&I users.

Use of CVP Water. On July 22, 1974, the City of Tracy signed a long-term contract (Contract 14-06-200-7858A) with Reclamation for 10,000 acre-feet of CVP water. This contract will expire in 2004.

Use of Other Available Water Supplies. The City of Tracy's water system includes CVP water from the Delta-Mendota Canal and groundwater pumped from nine groundwater wells located throughout the city. There are no other water supply sources serving the city; however, the City of Tracy is negotiating with The West Side Irrigation District for a permanent transfer of an additional CVP supply to help meet Tracy's growing demand. The South County Surface Water Project is also expected to supply 10,000 acre-feet of treated surface water from the Stanislaus River beginning as soon as 2004. Banta-Carbona Irrigation District and Plain View Water District have also informed Reclamation of their intent to transfer a portion of their CVP supplies to the City of Tracy by 2025.

Coehlo Family Trust's Facilities and Water Use

About 1,120 acres of the Coehlo Family Trust property are currently under contract with Reclamation to receive CVP water. Because of its small size, the trust is exempt from Section 3405(e) of the CVPIA, which requires the preparation of a water conservation plan. The property receives its CVP allocation directly from the Mendota Pool and conveys the water through its own distribution system to the property. Figures 4.1-10 and 4.1-11 show the current land uses and habitat types for the Coehlo Family Trust property.

The Coehlo Family signed a long-term contract (Contract 14-06-200-7589A) with Reclamation to supply 3,525 acre-feet of CVP water until December 23, 2003. A binding agreement for early renewal of CVP water was signed on September 30, 1997 (Contract 14-06-200-7859A-BA).[2]

In addition to its CVP supply, the Coehlo Family Trust property has groundwater wells that provide a supplemental supply in dry years. The Coehlo Family Trust also had 5,200 acre-feet of supplemental water and 2,653 acre-feet of Schedule 2 water for water

[2] An additional mitigation and restoration payment of 150 percent of the annual payment calculated under the CVPIA is required for long-term contractors whose contracts were in existence on October 30, 1992, but had not been renewed between January 1, 1988, and October 29, 1992. However, since the PEIS was not completed by October 1, 1997, the additional mitigation and restoration payment does not apply to long-term contractors with a contract in existence on the date of CVPIA enactment (October 30, 1992) who enter into a binding agreement with the Secretary prior to October 1, 1997, to renew their contracts immediately upon completion of the PEIS, if such contract has not expired prior to completion of the PEIS.

rights.[3] It subsequently assigned 3,120 acre-feet of the supplemental water and 1,321 acre-feet of Schedule 2 water to the California Department of Fish and Game.

Del Puerto Water District Facilities and Water Use

The Del Puerto Water District was originally organized on March 24, 1947, and included approximately 3,875 acres. The district was reorganized on March 1, 1995, through a formal consolidation with ten other districts.[4] The reorganized Del Puerto Water District is located on both sides of the Delta-Mendota Canal and consists of a narrow strip of land averaging less than two miles in width and stretching 50 miles in length. Del Puerto Water District includes approximately 47,400 acres located along the west side of Stanislaus, San Joaquin and Merced Counties. Stanislaus County serves as the principal county for the district. Figures 4.1-12 and 4.1-13 show the current land uses and habitat types for the Del Puerto Water District service area.

The district receives its CVP supply directly through turnouts on the Delta-Mendota Canal. This district does not have any distribution facilities and does not own any pumps, pipelines, or canals to transport the CVP supply. All turnouts, pumps, pipelines, and canals in the district are privately owned, maintained, and operated. The district owns and maintains only the water meters.

Use of CVP Water. On June 10, 1953, Del Puerto Water District signed a long-term contract (Contract 14-06-200-922) with Reclamation for 10,000 acre-feet of CVP water. After the 1995 consolidation, the water service contracts of the other ten districts were assigned to Del Puerto Water District and were subsequently renegotiated as a single contract. Under the single contract, Del Puerto received 140,210 acre-feet of CVP water. Since the expiration of those individual contracts, a series of interim contracts have been executed. The most recent (Contract 14-06-200-922-IR5) was executed on February 29, 2000.

Use of Other Available Water Supplies. Del Puerto Water District has no groundwater wells and does not receive water supplies from any source other than the CVP.

Operating Rules and Regulations. All of the distribution and drainage systems in the Del Puerto Water District are owned, operated, and maintained by individual water users; therefore, the district has not instituted a drainage policy. The district, however, maintains

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[3] Schedule 2 water is all water delivered without charge under the authority of Section 14 of the Reclamation Project Act o f 1939, as a permanent adjustment and settlement of a district's asserted claims to water in the Fresno Slough tributary to the San Joaquin River in fulfillment of such rights pursuant to Contract No. I7r-1145, "Contract for Purchaser of Mller & Lux Water rights," dated July 27, 1939.

[4] Districts consolidated to form Del Puerto Water District are Hospital, Kern Canon, Salado, Sunflower, Orestimba, Foothill, Davis, Mustang, Quinto, and Romero.

a cooperative stance with downslope districts regarding problems arising from tailwater leaving district boundaries and will take necessary actions to remedy such problems.

The district's policy on water transfers is to allow transfers of allocated water supply between parcels of land, either within the district or between districts, when the supply is associated with lands owned by the same landowner. Therefore, the only water transfers outside the district are transfers from a landowner to itself.

Eagle Field Water District's Facilities and Water Use

Eagle Field Water District is approximately 1,372 acres in size and is located in both Merced and Fresno Counties. Because of its small size, the district is exempt from Section 3405(e) of the CVPIA, which requires the preparation of a water conservation plan. The district is located between the Outside Canal and the Delta-Mendota Canal. Figures 4.1-14 and 4.1-15 show the current land uses and habitat types for the Eagle Field Water District service area.

Eagle Field Water District receives its CVP water supply directly from two turnouts on the Delta-Mendota Canal. The district has no additional conveyance facilities. All administrative functions for the Eagle Field Water District are being provided by the Panoche Water District.

Use of CVP Water. On April 10, 1858, the district signed a long-term contract (Contract 14-06-200-7754) with Reclamation for 4,550 acre-feet of CVP water. The contract expired on February 25, 1995. Since then, a series of interim contracts have been executed. The most recent interim contract (Contract 14-06-200-7754-IR3) was executed on February 29, 2000.

Use of Other Available Water Supplies. In addition to CVP supply, Eagle Field Water District has groundwater wells that provide a supplemental supply in dry years.

Operating Rules and Regulations. Eagle Field Water District is part of the Panoche Drainage District. The drainage district, which is comprised of Panoche, Eagle Field, Oro Loma, and Mercy Springs Water Districts, was formed in the late 1950s to transport subsurface drainage water and tailwater from district lands. Historically, the Panoche Drainage District has been able to drain its discharge water through the Grassland Water District and into the San Joaquin River. Currently, as part of the Grasslands Bypass Project, the drainage district is required to remove its drainage water from the Grasslands Channels and convey the water through the existing San Luis Drain and into the San Joaquin River at the same point.

Eagle Field Water District is active in water transfers and in the past year has transferred water to other districts including Panoche Water District.

Fresno Slough Water District's Facilities and Water Use

Formed in 1956, the Fresno Slough Water District is about 1,200 acres in size. Because of its small size, the district is exempt from Section 3405(e) of the CVPIA, which requires the preparation of a water conservation plan. The district is located in western portion of Fresno County and is adjacent to Tranquillity Irrigation District to the east. Figures 4.1-16 and 4.1-17 show the current land uses and habitat types for the Fresno Slough Water District service area.

After the Delta-Mendota Canal releases water into the Mendota Pool, some of the supply then flows from the pool into the Fresno Slough (or Kings River Bypass). The Fresno Slough Water District lifts its allocation of CVP water from the Fresno Slough into its own distribution system, which consists of approximately seven miles of unlined canals and two lift pump locations with two pumps at each lift. Fresno Slough Water District distributes the water to a number of unmetered turnouts.

Use of CVP Water. On July 30, 1998, the Fresno Slough Water District signed a long-term contract (Contract 14-06-200-4019A) with Reclamation for 3,500 acre-feet of water from the Delta-Mendota Canal. The contract will expire in 2003.

Use of Other Available Water Supplies. In addition to CVP supplies, the district receives a 866 acre-feet of Schedule 2 water for water rights and has an additional contract with Reclamation for 4,000 acre-feet of CVP water. The district also owns two deep groundwater wells, which are used for backup supplies during periods of high demand. No groundwater recharge program is currently in place and the quality of the groundwater is poor with high salinity.

Operating Rules and Regulations. The district is active in transfers of water both in and out of the district. Typically, any transfers out of the district would first be offered to neighboring Tranquillity Irrigation District. Because of the crop types grown in the district and the weather, this year Fresno Slough Water District anticipates transferring a portion of its CVP contract water to the Westlands Water District.

James Irrigation District's Facilities and Water Use

Formed in February 1920, James Irrigation District is about 41.2 square miles in size. The district is located within the central portion of the San Joaquin Valley, about 30 miles southwest of Fresno in Fresno County. Most of the land in the district was part of a land grant received by pioneer Jefferson G. James in 1858. Land in the district is relatively flat and soils range from coarse sands to heavy clays. Soils in the middle and western portions of the district generally have a higher clay content. Figures 4.1-18 and 4.1-19 show the current land uses and habitat types for the James Irrigation District service area.

James Irrigation District's distribution system consists of 91.5 miles of unlined canal, 14.3 miles of lined canal, and 6 miles of pipeline. The main canal operates as a lift canal for surface water that is pumped from the Mendota Pool into the Fresno Slough (or Kings River Bypass). A series of booster stations are then located along the distribution system to feed the various laterals and sublaterals. The entire length of the main canal is unlined. All but three of the 356 turnouts in the district are measured and read daily.

The district also has a regulation reservoir with a capacity of about 100 acre-feet and a storage reservoir with a capacity of about 900 acre-feet. James Irrigation District hopes to use these facilities to increase the amount of Kings River flood release water that is used for groundwater recharge to offset overdraft conditions rather than being lost to downstream users or the San Francisco Bay-Delta Estuary. However, since the facilities have been in place, no water has been available for groundwater recharge.

Use of CVP Water. James Irrigation District is one of the last contractors to obtain CVP water that has flowed from the Mendota Pool into Fresno Slough (or Kings River Bypass). On December 23, 1963, James Irrigation District entered into a long-term contract (Contract 14-06-200-700-A) with Reclamation for 35,300 acre-feet of CVP water. The contract will expire in 2003.

Use of Other Available Water Supplies. Historically, James Irrigation District received its water supply from the Kings River through a series of canals built in the late 1800s. However, the Kings River water supply was not reliable, and as one of the last districts along the river, it was also one of the last to receive water. In dry years, little or no water was available. The district also built a canal from the San Joaquin River. San Joaquin River water was also not very reliable and the supply was available only when flows exceeded the needs of other users. After Friant Dam was completed in 1944, the district began pumping San Joaquin River water directly from the Mendota Pool on an annual basis until August 1 of each year, with no limit on quantity. After the Delta-Mendota Canal was completed in 1951, CVP supply replaced the district's water supply.

The district has been a member of the Kings River Water Association since 1921. In 1963, James Irrigation District entered into agreements with Reclamation and the Kings River Water Association to establish entitlements to surface water from the San Joaquin and Kings Rivers. As a result, the district received an allocation of riparian water from the San Joaquin River that is delivered without charge as a settlement of the district's water rights claims in Fresno Slough. The amount of water delivered varies depending on whether the year is normal, wet or dry. The district also traded all of its allocation of scheduled Kings

River water to the Lower Kings River Water Association in exchange for agreed-upon payments to the district. Since these agreements, the district receives Kings River water only when flood releases are made. In the next few years, the district plans to purchase portable lift pumps to deliver Kings River flood releases (when available) to farms east of the district for in-lieu groundwater recharge and to use the regulation and storage reservoirs.

In addition to these surface water sources, groundwater is used as a supplemental supply. All but two wells are district-owned. The district generally uses any and all surface supplies available and then pumps groundwater to make up for any shortfall. Groundwater is pumped mostly along the eastern boundary of the district, as groundwater in other areas is of poorer quality with high salinity and contamination plumes.

James Irrigation District also receives operational spill water from the Fresno Irrigation District, which is used for agricultural use. Also, in past years, Reclamation has made surplus water available to the district. This water is either imported from the Sacramento-San Joaquin Delta through the Delta-Mendota Canal or is a San Joaquin River Flood Release (called "Section 215" water by Reclamation). James Irrigation District also receives 9,700 acre-feet of Schedule 2 water for water rights.

Operating Rules and Regulations. Growers in James Irrigation District are permitted to pump tailwater back into district canals, allowing the tailwater to be recycled and reused in the district's system. This activity must be coordinated with the district’s responsible ditchtender.

James Irrigation District is also active in water transfers to and from other CVP contractors and other members of the Kings River Water Association. The district, however, has not allowed individual growers to transfer their CVP allocation from land farmed within the district to land owned by the same individual but farmed outside of the district. The district would generally not approve water transfers that result in an overall loss of water that could have been used within the district.

Laguna Water District’s Facilities and Water Use

Laguna Water District is approximately 417 acres in size and is located in Fresno County. Because of its small size, the district is exempt from Section 3405(e) of the CVPIA, which requires the preparation of a water conservation plan. Figures 4.1-20 and 4.1-21 show the current land uses and habitat types for the Laguna Water District service area.

Laguna Water District has no distribution facilities of its own. Instead, the district has a contract with the Central California Irrigation District for transportation of its CVP water. The Delta-Mendota Canal releases water into the Mendota Pool and then water is transported from the pool to the Laguna Water District through distribution facilities of the Central California Irrigation District.

Use of CVP Water. On May 26, 1982, the district signed a long-term contract (Contract 2-07-20-W0266) with Reclamation for 800 acre-feet of CVP water. This contract expired on December 31, 1995. Since then, a series of interim contracts have been executed.

Use of Other Available Water Supplies. The district has no water supplies other than the CVP allocation.

Mardelia Hughes' Facilities and Water Use

About 10.99 acres of the Mardelia Hughes property is currently under contract with Reclamation to receive CVP water. Because of its small size, the property is exempt from Section 3405(e) of the CVPIA, which requires the preparation of a water conservation plan. The property receives its CVP allocation directly from the Mendota Pool and transfers the water through its own distribution system to the property. Figures 4.1-22 and 4.1-23 show the current land uses and habitat types for the Mardelia Hughes property.

On October 11, 1967, a long-term contract (Contract 14-06-200-3537A) was signed between Reclamation and the Hughes property for 70 acre-feet of CVP water until December 23, 2003. A binding agreement for early renewal of CVP water was signed on September 30, 1997 (Contract 14-06-100-3537A-BA). The Mardelia Hughes property also receives 93 acre-feet of Schedule 2 water for water rights. The Mardelia Hughes property has no other water supply sources.

Mercy Springs Water District's Facilities and Water Use

Mercy Springs Water District is approximately 3,390 acres in size and is located in Fresno County. The district spans the Main Canal, Outside Canal, and the Delta-Mendota Canal. Figures 4.1-24 and 4.1-25 show the current land uses and habitat types for the Mercy Springs Water District service area.

Mercy Springs Water District receives its CVP water directly from a turnout on the Delta-Mendota Canal and has no additional conveyance facilities.

Use of CVP Water. On June 21, 1967, the district signed a long-term contract (Contract 14-06-20-3365A) with Reclamation for 13,300 acre-feet of CVP water. This contract expired on February 28, 1995. Since then, a series of interim contracts have been executed. The most recent interim contract (Contract 14-06-200-3365A-IR3A) was executed on February 29, 2000.

A portion of Mercy Springs CVP allocation, representing 6,260 acre-feet, was assigned to Pajaro Valley Water Management Agency, Westlands Water District, and Santa Clara Valley Water District. This partial assignment, entered into through an agreement dated May 14, 1999, subsequently reduced the Mercy Springs CVP allocation to 7,040 acre-feet.

Use of Other Available Water Supplies. In addition to CVP supply, Mercy Springs Water District has groundwater wells that provide a supplemental supply in dry years.

Operating Rules and Regulations. Mercy Springs Water District is part of the Panoche Drainage District. The drainage district, which is comprised of Panoche, Eagle Field, Oro Loma, and Mercy Springs Water Districts, was formed in the late 1950s to transport subsurface drainage water and tailwater from district lands. Historically, the drainage district had been able to drain its discharge water through the Grassland Water District and into the San Joaquin River. Currently, the Panoche Drainage District is required to remove its drainage water from the Grasslands Channels and convey the water through the existing San Luis Drain and into the San Joaquin River at the same point (known as the Grasslands Bypass Project).

Mercy Springs Water District decided not to participate in the Grasslands Bypass Project; therefore, the district, which is drained by deep drainage ditches, currently lacks a drainage outlet. As part of a land management program to reduce drain water and improve wildlife habitat that was implemented with a Reclamation grant, Panoche Water District will now develop a portion of Mercy Springs into alternative land management by changing historical cropping rotations. Portions of the district will be planted to alfalfa, Bermuda grass, and other salt-tolerant grasses that will be irrigated with CVP water, well water, and subsurface drainage water from Panoche Water District. The area will be used to establish the sustainability and feasibility of salt-tolerant grass for the continuous use of blended subsurface drainage water.

Mercy Springs Water District is active in water transfers and in past years has transferred water out to other districts, including Westlands Water District.

Oro Loma Water District's Facilities and Water Use

Oro Loma Water District is located in Fresno County. Because of its small size, the district is exempt from Section 3405(e) of the CVPIA, which requires the preparation of a water conservation plan. The district is located between the Outside Canal and the Delta-Mendota Canal. Figures 4.1-26 and 4.1-27 show the current land uses and habitat types for the Oro Loma Water District service area.

Oro Loma Water District receives its CVP water directly from two turnouts on the Delta-Mendota Canal and has no additional conveyance or distribution facilities.

Use of CVP Water. On April 7, 1959, the district signed a long-term contract (Contract 14-06-200-7823) with Reclamation for 4,600 acre-feet of CVP water. This contract expired on February 28, 1995. Since then, a series of interim contracts have been executed. The most recent interim contract (Contract 14-06-200-7823-IR3) was executed on February 29, 2000.

Use of Other Available Water Supplies. In addition to CVP supply, Oro Loma Water District has groundwater wells that provide a supplemental supply in dry years.

Operating Rules and Regulations. Oro Loma Water District is part of the Panoche Drainage District. The drainage district, which is comprised of Panoche, Eagle Field, Oro Loma, and Mercy Springs Water Districts, was formed in the late 1950s to transport subsurface drainage water and tailwater from district lands. Historically, the Panoche Drainage District had been able to drain its discharge water through the Grassland Water District and into the San Joaquin River. Currently, the Panoche Drainage District is required to remove its drainage water from the Grasslands Channels and convey the water through the existing San Luis Drain and into the San Joaquin River at the same point (known as the Grasslands Bypass Project).

Oro Loma Water District is active in water transfers and in past years has transferred water out to other districts, including Panoche Water District.

Patterson Irrigation District's Facilities and Water Use

The Patterson Water District was formed in November 1955 at an original size of approximately 15,000 acres. After a series of exclusions, the size of the district in 1996 was 13,225 acres. All of these acres are irrigated. After being formed, Patterson Water District later changed to Patterson Irrigation District. The primary differences between irrigation and water districts are the range of purposes underlying their formation, eligible lands, and voting systems.

Patterson Irrigation District is located in Stanislaus County and is adjacent to West Stanislaus Irrigation District to the northwest and Del Puerto Water District to the southwest. The district includes 425 landowners and over 600 water users. Figures 4.1-28 and 4.1-29 show the current land uses and habitat types for the Patterson Irrigation District service area.

The Patterson Irrigation District distribution system consists of 3.8 miles of unlined canal, 51.8 miles of concrete-lined canal, and 84 miles of pipeline. The main canal flows from east to west and the main laterals that come off the main canal and flow to the north and south. The district also has a series of lift pump stations, four reservoirs that are located off the main canal, and two smaller reservoirs located off the main laterals. Originally designed as settling basins to settle out silt from San Joaquin River source water, the reservoirs have negligible storage capacity.

Use of CVP Water. On December 18, 1967, Patterson Irrigation District entered into a long-term contract (Contract 14-06-200-3598A) with Reclamation for 16,500 acre-feet of CVP water. This contract expired on February 28, 1995. Since then, a series of interim contracts have been executed. The most recent interim contract (Contract 14-06-200-3598A-IR3) was executed on February 29, 2000.

Use of Other Available Water Supplies. In addition to the CVP supply, Patterson Irrigation District receives local surface water from the San Joaquin River and also pumps groundwater. The district's San Joaquin River and groundwater supply sources have high concentrations of salt that limit cropping patterns and affect water quality conditions and crop yields. Salinity conditions in the river are well documented by the Regional Water Quality Control Board. The district also receives an additional 6,000 acre-feet of replacement water from Reclamation because CVP water allocations have reduced San Joaquin River flows.

Operating Rules and Regulations. Patterson Irrigation District has aggressively pursued an automation and modernization plan since 1997 and this is expected to continue in the future. Modernization efforts include replacing less efficient pumps and motors and constructing Replogle flumes for accurate flow measurement and long-crested weirs for water level control. As they are implemented, these efforts will continue to increase the efficiency of the district's system.

Through a funding program provided by Reclamation, Patterson Irrigation District is actively working with the Irrigation Training and Research Center at California Polytechnic State University on developing a canal automation system that would include flowmeters and volumetric options for measuring flow rate.

Any tailwater or drainage water return flows in the district either percolate into the groundwater aquifer or end up in the San Joaquin River via direct drain facilities. A small quantity also enters Del Puerto Creek. Most of the tailwater that ends up in the San Joaquin River is reused. Approximately one-half of the return flows enter the San Joaquin River upstream of the district's diversion and, therefore, are available for reuse by the district. The other one-half enters the San Joaquin River downstream of the district's diversion and is available to other downstream users. The reuse of return flows either within the district or by other users promotes good water management by conserving water.

Patterson Irrigation District is active in water transfers both into and out of the district. In recent years, water has been transferred to West Stanislaus Irrigation District and Westlands Water District.

Plain View Water District's Facilities and Water Use

Plain View Water District was formed on January 15, 1951. The district is located in San Joaquin County primarily along the eastern side of Interstate 5 near the city of Tracy. The district was originally 6,000 acres in size with 5,316 irrigated acres and is currently 6,422 acres in size with 5,987 irrigated acres. Figures 4.1-30 and 4.1-31 show the current land uses and habitat types for the Plain View Water District service area.

Plain View Water District receives its CVP water directly from the Delta-Mendota Canal through 28 turnouts. The district's distribution system consists of 9.2 miles of pipeline. The system is an entirely enclosed pipeline system constructed of reinforced concrete pipe and polyvinylchloride pipe that was installed to replace the original Techite pipe. There are no open ditches or canals in the system. Propeller meters measure the flow volume to each point of delivery.

Use of CVP Water. On May 22, 1953, Plain View Water District entered into a long-term contract (Contract 14-06-200-785) with Reclamation for 17,250 acre-feet of CVP water. In 1974, the district annexed additional land and the contract was amended on July 25, 1975. Under the amendment, Reclamation provided 20,600 acre-feet of CVP water to the district. The long-term contract expired on February 28, 1994. Since then, a series of interim contracts have been executed. The most recent interim contract (Contract 14-06-200-785-IR5) was executed on February 29, 2000.

Use of Other Available Water Supplies. Plain View Water District currently has no water supply source other than the CVP supply.

Operating Rules and Regulations. There is no subsurface drainage in Plain View Water District. The drainage is either recirculated on-farm or discharged to either the Delta-Mendota Canal or The West Side Irrigation District for reuse.

Plain View Water District is active in transferring water both to and from other contractors. To date, however, the district has not allowed individual transfers. Plain View Water District has also informed Reclamation that it intends to transfer a portion of its CVP supply to the City of Tracy by 2025.

Reclamation District #1606's Facilities and Water Use

Reclamation District #1606 is approximately 170 acres in size. Because of its small size, the district is exempt from Section 3405(e) of the CVPIA, which requires the preparation of a water conservation plan. The district is located in Fresno County and is adjacent to James Irrigation District. It was originally formed for flood protection along the Kings River. In 1914, Reclamation District #1606 constructed two channels along its neighboring district, James Irrigation District. These channels were constructed to make a continuous connection from the Kings River to the San Joaquin River, to pass floodwater through the area, and to prevent flooding of the two districts. Figures 4.1-32 and 4.1-33 show the current land uses and habitat types for the Reclamation District #1606 service area.

The Delta-Mendota Canal releases water into the Mendota Pool, and some of this supply then flows into the Fresno Slough (or Kings River Bypass). Reclamation District #1606 pulls its CVP supply from the Fresno Slough using two lift pumps.

Use of CVP Water. On April 12, 1968, Reclamation District #1606 signed a long-term contract (Contract 14-06-200-3802A) with Reclamation for 228 acre-feet of CVP water until December 23, 2003. A binding agreement for an early renewal contract was executed with Reclamation (Contract 14-06-200-3802A-BA) on September 30, 1997.

Use of Other Available Water Supplies. Reclamation District #1606 also receives 342 acre-feet of Schedule 2 water for water rights. The district has no other water supply sources.

The West Side Irrigation District's Facilities and Water Use

The West Side Irrigation District was organized on October 12, 1915, and made its first water deliveries in 1919. The district is located in San Joaquin County and is divided in half by the city of Tracy. The district was originally about 12,160 acres in size with 10,800 irrigated acres and is currently 9,436 acres in size with 8,500 irrigated acres. Figures 4.1-34 and 4.1-35 show the current land uses and habitat types for The West Side Irrigation District service area.

CVP water is diverted from the Delta-Mendota Canal through two turnouts. One turnout ties into the district's upper main canal through a 1.8-mile-long concrete pipe and the second turnout ties into the district's upper main canal through a 1.4-mile-long concrete pipe. Both are gravity flow systems. The upper main canal is nine miles in length (including 1 mile of concrete-lined canal, 3.5 miles of pipeline and 4.5 miles of unlined canal) and includes 11 miles of concrete piped laterals. The lower main canal is also nine miles in length (including 1.5 miles of concrete-lined canal, 3 miles of pipeline, and 5.5 miles of unlined canal) and includes 13 miles of concrete piped laterals. All of the gates in the system are manual and all flows in the district's distribution system are measured regularly.

Use of CVP Water. In June 1977, The West Side Irrigation District entered into a long-term contract (Contract 7-07-20-W-0045) with Reclamation for 7,500 acre-feet of CVP supply. This new contract expired on February 28, 1995. Since then, a series of interim contracts have been executed. The most recent interim contract (Contract 7-07-20-W0045-IR3) was executed on February 29, 2000.

Use of Other Available Water Supplies. The district has received water from the San Joaquin River from water rights dating back to 1916. San Joaquin River water is diverted through a dredged unlined intake canal and flowed by gravity into the district's pumping facilities. The water is then lifted through two pipelines; one terminates at the beginning of the Lower Main Canal and the other discharges into the Upper Main Canal and mixes with CVP water. The water then flows by gravity, similar to the CVP supply, and is delivered to users. Because of its degraded quality and reliability, San Joaquin River water is only used as a supplement when CVP water supplies are insufficient to meet demand.

There are no groundwater or private irrigation wells within the district. The district has no water supplies other than CVP and San Joaquin River water.

Operating Rules and Regulations. The West Side Irrigation District has a tailwater return flow collection (surface drainage) system to provide drainage to all the lands within the district. No drainage (or tailwater) leaves The West Side Irrigation District boundaries. The district has constructed facilities to collect drainage water and return it to the district's intake canals where it is combined with San Joaquin River water and pumped back into the conveyance facilities for reuse. Tailwater is also received from Plain View Water District and recirculated into the district's system.

The West Side Irrigation District is active in water transfers. Transferred water has been received water from other districts, including the Banta-Carbona Irrigation District, and has been transferred to other districts, including Plain View Water District. The West Side Irrigation District has also informed Reclamation of its intent to transfer a portion of its CVP water supply to the City of Tracy by 2025.

Tranquillity Irrigation District's Facilities and Water Use

Formed in 1918, Tranquillity Irrigation District is approximately 10,750 acres in size. The district is located in the west central portion of Fresno County; its principal community is the unincorporated town of Tranquillity. The district does not currently have a water conservation plan as required by Section 3405(e) of the CVPIA. While it is anticipated that the district will prepare a water conservation plan, the schedule for the availability of such a document is not known.

The Delta-Mendota Canal releases water into the Mendota Pool, and some of this supply then flows into the Fresno Slough (or Kings River Bypass). The district then lifts its allocation of CVP water from the Fresno Slough into its own distribution system, which consists of 42 miles of unlined canal, 10 miles of pipelines, two major lift pump stations, and a series of lifts. The entire system is both metered and automated including automated gates at the turnouts. The district is constantly seeking ways to upgrade and improve its distribution system, including low interest loans and bond money, including water conservation bond money to convert open canals in the district to pipelines.
Figures 4.1-36 and 4.1-37 show the current land uses and habitat types for the Tranquillity Irrigation District service area.

Use of CVP Water. On December 23, 1963, Tranquillity Irrigation District signed a long-term contract (Contract 14-06-200-701A) with Reclamation for 13,800 acre-feet of water until December 23, 2003. A binding agreement for an early renewal of CVP water was signed on September 30, 1997 (Contract 14-06-200-701-A-BA).

Use of Other Available Water Supplies. Tranquillity Irrigation District has six groundwater wells, which are used as a backup supply during periods of high demand. The district also maintains two deep groundwater wells for the domestic water system for the community. No individual landowners own or operate any deep groundwater wells. Because a portion of the district's CVP supply is transferred to the Kings River in accordance with a previous agreement, the district purchases supplemental water from Reclamation to make up for the loss of this water. Tranquillity Irrigation District also receives 20,200 acre-feet of Schedule 2 water for water rights.

Operating Rules and Regulations. District policy allows transfers both into and out of the district. The district has historically been active in transfers and has transferred water both to other CVP contractors (including Westlands Water District, San Luis Water District, and Panoche Water District) and to other entities including the State Drought Bank.

West Stanislaus Water District's Facilities and Water Use

West Stanislaus Irrigation District was formed on May 20, 1920 and has been in continuous operation since. Located in portions of both Stanislaus and San Joaquin Counties, the district overlies a portion of the San Joaquin Valley groundwater basin, in the northern portion of the Delta-Mendota Basin, and the southern portion of the Tracy Basin, which is drained by the San Joaquin River. The first water deliveries were made in 1929. The current size of the district is 24,800 acres, of which 21,500 acres are irrigated. The district is adjacent to Banta-Carbona Irrigation District to the north, Patterson Irrigation District to the south, and Del Puerto Water District to the west. Figures 4.1-38 and 4.1-39 show the current land uses and habitat types for West Stanislaus Water District service area.

West Stanislaus Irrigation District current distribution system consists of a three-mile-long, concrete-lined main canal and 84 miles of laterals and sublaterals that are either canals or pipelines. Sixty-eight of these 84 miles are either concrete-lined canals or concrete pipe. The main canal carries water supplied by six pumping plants. The district receives water from the Delta-Mendota Canal through two diversion points.

The district has a continuous monitoring system of accurate measurement for water diverted into the laterals. The water measurements are taken three times daily at the water user's turnouts, and control structures in the laterals control the level of water and regulate the flow.

CVP Water Supply. On July 14, 1953, West Stanislaus Irrigation District signed a long-term contract (Contract 14-06-200-1072) with Reclamation for 20,000 acre-feet of CVP water. The contract amount was increased to 50,000 acre-feet in 1976. The contract expired on February 28, 1994. Since then, a series of interim contracts have been executed. The most recent interim contract (Contract 14-06-200-1072-IR5) was executed on February 29, 2000.

Use of Other Available Water Supplies. Since 1929, West Stanislaus Irrigation District has had the right to divert water from the San Joaquin River. However, after construction of Friant Dam and the diversion of river water to the southern part of the valley, the quantity available to the district became inadequate and the quality has continued to degrade and become more saline. The district also uses four groundwater wells, drilled in 1977, as a supplemental water source during peak demands. However, use of these wells is limited because of high pumping costs and water quality concerns. Some landowners within West Stanislaus Irrigation District own private groundwater wells to service their property.

Operating Rules and Regulations. West Stanislaus Irrigation District has a surface drainage system to collect tailwater. All of the surface drainage eventually finds its way to the San Joaquin River. The water that flows in the natural channels goes directly to the river and the other facilities discharge onto riparian land adjacent to the river, which enhances the riparian habitat.

West Stanislaus Irrigation District allows water transfers into and out of the district.

Widren Water District's Facilities and Water Use

Widren Water District is approximately 800 acres in size and is located in Fresno County on the Delta-Mendota Canal. Because of its small size, the district is exempt from Section 3405(e) of the CVPIA, which requires the preparation of a water conservation plan. Figures 4.1-40 and 4.1-41 show the current land uses and habitat types for the Widren Water District service area.

The district has one turnout on the Delta-Mendota Canal and no other improvements.

Use of CVP Water. On September 25, 1959, the district signed a long-term contract (Contract 14-06-200-8018) with Reclamation for 2,990 acre-feet of CVP water. Since the contract expired on February 28, 1995, Widren Water District has been receiving CVP water under an interim renewal contract with Reclamation.

Use of Other Available Water Supplies. The district has no water supplies other than the CVP allocation.

Operating Rules and Regulations. Along with other Grassland basin drainers, including Broadview Water District, Widren Water District has been draining discharge water (or tailwater) through the Grassland Water District and into the San Joaquin River. Currently, as part of the Grasslands Bypass Project, the Widren Water District is required to remove its drainage water from the Grasslands Channels and convey the water through the existing San Luis Drain and into the San Joaquin River at the same point. The district is an active participant in water transfers and has transferred water to Westlands Water District in past years.

Interpretation of Figures 4.1-2 Through 4.1-41

Some discrepancies may appear to exist between land use and habitat typing of some contractor areas. This is a result of different dates and resolutions of the source data. For instance, land use data from the California Department of Conservation's Farmland Mapping and Monitoring Program (FMMP) shows more urban area than the comparative habitat information from the California Department of Fish and Game's Geographic Assistance to Planning (GAP) data. Although both data sets have the same 1998 publication date, the FMMP data originates from U.S. Department of Agriculture/ Natural Resources Conservation Service soil surveys combined with current, county-level land use reporting (minimum mapping unit of 10 acres), while the GAP data relies on remotely-sensed satellite data from 1990 (minimum mapping unit of approximately 250 acres). In all cases, the most current data from reliable agencies have been used.

Pages 25 through 64
are found in the
“Part 4 - Figures” section

SECTION 4.2: AGRICULTURE

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on agricultural productivity in the Delta-Mendota Canal Unit. Methods of analysis are described below.

AFFECTED ENVIRONMENT

Renewal of the long-term contracts could potentially affect the following agricultural resources:

- Income from agricultural production (both gross and net)
- Irrigated acres under production

The study area includes the geographic service areas of the CVP water contractors within the Delta-Mendota Canal Unit, as described in Section 4.1.

The contractor service areas all run roughly along the Interstate 5/California Aqueduct corridor from the city of Tracy in San Joaquin County in the north, through parts of Stanislaus and Merced Counties, to the northern portion of Fresno County, just south of U.S. Highway 180, to the south. The farmland served by much of this water lies in the heart of California's Central Valley, one of the most productive agricultural regions in the world.

Agricultural products grown or raised in the unit are extremely varied. The Central Valley of California boasts not only a wide variety of agricultural products, but also exceptional productivity of the crops and livestock produced here. From alfalfa to zucchini, if it is grown somewhere in North America, it is probably grown somewhere in the Central Valley. Fruits, nuts, and vegetables are particularly noteworthy crops in the area because of the lack of substitute growing regions elsewhere.

In terms of product volume and value, hay, corn silage, sugar beets, and cotton are the dominant field crops; grapes and almonds are the dominant orchard crops; tomatoes are the dominant row crop; and dairy and poultry are the dominant livestock products in San Joaquin, Stanislaus, Merced, and Fresno Counties.

Agricultural producers in the Central Valley and elsewhere operate under several economic pressures. When it comes to the sale of their product, they are "price-takers." Because no producer has enough market share to exercise any control over the market, the price they receive for their products is determined entirely outside their control.

The agricultural production cycle is not rapid. Decisions regarding a producer's product mix have to be made months or even years in advance. When July arrives and it is evident that corn is going to be more profitable to produce that year than tomatoes would have been, it is too late for the producer to change what they will produce for that year. If tomatoes were planted, tomatoes will be harvested. In the case of orchards, the production cycle stretches across many years.

Weather greatly impacts the quantity and quality of agricultural production. Certainly, no producer has control over the weather.

Changes in the cost or availability of production inputs also play a large part in the ability of a producer to remain viable. Land, labor, seed, machinery, fertilizers, and water are all important and interrelated components in determining production decisions and enterprise profitability. A decrease in the availability of water or an increase in the cost of water or both can not only decrease or eliminate profits per acre, it can also determine cropping patterns or the ability to utilize other inputs, such as land.

ENVIRONMENTAL CONSEQUENCES

This section describes the environmental impacts of the action alternatives as compared to the No-Action Alternative. Impacts are identified by comparing program components of each action alternative to the No-Action Alternative. The project alternatives are described more fully in Chapter 2.

Impacts are presented for the project area as a whole (the entire Delta-Mendota Canal Unit). As with all impacts within the project area, the concentration of impacts to a smaller geographic area within the project area increases the relative impact, while a more uniform dispersion of impacts across the project area decreases the relative impact. While it is highly unlikely that all identified impacts would present themselves within a single water district, it is just as unlikely that a fully uniform dispersion of impacts across the entire project area would occur.

While this assessment is not able to geographically pinpoint the location of impacts within the project area, it is likely that greater impacts could be seen in those areas where fewer opportunities to substitute water resources occur. If that is the case, then impacts may be more concentrated among those water districts where CVP water is the only available surface water and groundwater resources are limited. Such districts include Broadview Water District, Centinella Water District, Del Puerto Water District, Laguna Water District, Plain View Water District, Reclamation District #1606, Widren Water District, and the Mardelia Hughes property.

In the case of agricultural impacts, there can also be the issue of relative severity to individual producers. The same level of change resulting from implementation of an alternative will cause different degrees of impact to different producers. As an example, taking ten acres of orchard out of production will likely cause a much larger impact to a producer who has only 30 acres in production than it will to a producer who has 1,000 acres in production.

NO-ACTION ALTERNATIVE

As described in Chapter 2, the No-Action Alternative provides a base condition for comparing Alternatives 1 and 2 and represents future conditions at a projected level of development without implementation of either alternative. The No-Action Alternative reflects the conditions that are expected to be present upon implementation of the Preferred Alternative from the CVPIA PEIS.

The data used to describe the No-Action Alternative conditions and those of the two renewal alternatives can be found in the April 24, 2000 Technical Memorandum titled *Economic Analysis of November 1999 Tiered Pricing Proposal for PEIS Preferred Alternative* (CH2M Hill, 2000), attached as Appendix A. It is important for the reader to understand the key assumptions contained in the April 24, 2000 Technical Memorandum.

The economic analysis in the April 24, 2000 Technical Memorandum evaluates agricultural economics using the Central Valley Production Model (CVPM). The CVPM provides analyses for specific subregions, not by individual water district. The CVPM subregions contained in the Delta-Mendota Canal Unit are Subregions 9, 10, and 15 (a more detailed description of the subregions can be found in Table 1 of the April 24, 2000 Technical Memorandum; Appendix A).

Tiered pricing for the No-Action Alternative is based on the current contract amount of water. Each contractor may purchase, as available, 80 percent of their full contract amount at the basic contract rate (Tier 1). The next 10 percent of the full contract amount (Tier 2) is priced at the midpoint between the basic contract rate and the full-cost rate (as defined in the Reclamation Reform Act). The last 10 percent of the full contract amount (Tier 3) is priced at the full-cost rate as defined in the Reclamation Reform Act. Table 4.2-1 shows the tiered water rates for each of the three CVPM subregions used for the No-Action Alternative. These rates are based on the 1992 CVP water rates.

Table 4.2-1
CVP Tiered Water Rates
Used in No-Action Alternative
(dollars per acre-foot)

CVPM Subregion	Tier 1	Tier 2	Tier 3
9	$28.54	$35.25	$41.95
10	$33.46	$40.02	$46.57
15	$28.16	$34.88	$41.59

Source: CH2M Hill, 2000, Table 3.

Using the tiered rates described in Table 4.2-1 and the farm budget assumptions within the CVPM, estimates of irrigated acreage and value of production for primary crops in each CVPM subregion were developed under average, wet, and dry water conditions. An average water year represents the average water delivery during the period 1922-1990 from the CVPIA PEIS Preferred Alternative; a wet water year represents the average delivery from the period 1967-1971 from the CVPIA PEIS Preferred Alternative; and a dry water year represents the average delivery from the period 1928-1934 from the CVPIA PEIS Preferred Alternative.

Table 4.2-2 describes the total irrigated acreage under the No-Action Alternative by primary crop and CVPM subregion in average, wet, and dry years.

Table 4.2-3 describes the value of production under the No-Action Alternative by primary crop and CVPM subregion in average, wet, and dry years.

It is worth noting that within the No-Action Alternative tiered pricing structure and rate levels, very little change is seen in either irrigated acreage or the value of crop production from average to wet to dry water years.

ALTERNATIVE 1

Alternative 1 involves a tiered pricing program that is based on the full current contract amount of water. A complete description is provided in Chapter 2.

Agricultural resource use resulting from this alternative is assumed to be similar to the No-Action Alternative because, as described in Table 2-1, the amount of water delivered, the timing of these deliveries, and the rates and methods of payment for water delivered under Alternative 1 do not substantially differ from the No-Action Alternative.

Table 4.2-2
No-Action Alternative Irrigated Acreage by CVPM Subregion and Crop
(thousands of acres)

CVPM Subregion	Crop Category	Average Year	Wet Year	Dry Year
9	Pasture	24.6	24.6	23.4
	Alfalfa	43.8	43.8	43.1
	Sugar Beets	28.6	28.6	28.5
	Other Field Crops	114.9	115.0	113.6
	Rice	0.9	0.9	0.9
	Truck Crops	46.0	46.0	46.0
	Tomatoes	42.5	42.5	42.3
	Deciduous Orchard	21.3	21.3	21.3
	Small Grain	96.8	97.5	93.7
	Grapes	5.8	5.8	5.8
	Subtotal	**425.2**	**426.0**	**418.6**
10	Pasture	13.3	13.3	13.3
	Alfalfa	40.8	40.9	40.8
	Sugar Beets	13.9	13.9	13.9
	Other Field Crops	48.2	48.2	48.3
	Rice	2.9	2.9	2.9
	Truck Crops	112.9	112.9	113.0
	Tomatoes	40.2	40.2	40.2
	Deciduous Orchard	36.6	36.6	36.6
	Small Grain	14.0	14.0	14.0
	Grapes	1.0	1.0	1.0
	Cotton	103.1	103.1	103.1
	Subtropical Orchard	0.1	0.1	0.1
	Subtotal	**427.0**	**427.1**	**427.2**
15	Pasture	3.9	3.9	3.7
	Alfalfa	83.1	83.4	80.6
	Sugar Beets	5.0	5.0	5.0
	Other Field Crops	86.0	86.1	84.2
	Rice	0.1	0.1	0.1
	Truck Crops	12.0	12.0	12.0
	Tomatoes	2.0	2.0	2.0
	Deciduous Orchard	38.0	38.0	38.0
	Small Grain	71.0	71.6	67.9
	Grapes	56.0	56.0	56.0
	Cotton	242.1	242.7	235.5
	Subtropical Orchard	1.0	1.0	1.0
	Subtotal	**600.2**	**601.8**	**586.0**
Total – All Subregions		**1,452.4**	**1,454.9**	**1,431.8**

Source: CH2M Hill, 2000, Table 17.

Table 4.2-3
No-Action Alternative Value of Production by CVPM Subregion and Crop
(millions of dollars)

CVPM Subregion	Crop Category	Average Year	Wet Year	Dry Year
9	Pasture	3.6	3.6	3.4
	Alfalfa	25.6	25.7	25.2
	Sugar Beets	22.0	22.0	21.9
	Other Field Crops	55.9	56.0	55.3
	Rice	0.7	0.7	0.7
	Truck Crops	190.8	190.8	190.6
	Tomatoes	64.9	65.0	64.8
	Deciduous Orchard	22.7	22.7	22.7
	Small Grain	30.7	30.9	29.7
	Grapes	10.0	10.0	10.0
	Subtotal	**426.9**	**427.4**	**424.3**
10	Pasture	3.1	3.1	3.1
	Alfalfa	23.6	23.6	23.6
	Sugar Beets	12.2	12.2	12.2
	Other Field Crops	31.0	31.0	31.0
	Rice	2.3	2.3	2.3
	Truck Crops	718.0	717.9	718.1
	Tomatoes	60.1	60.1	60.1
	Deciduous Orchard	52.4	52.4	52.4
	Small Grain	7.6	7.5	7.6
	Grapes	1.9	1.9	1.9
	Cotton	102.6	102.7	102.6
	Subtropical Orchard	0.4	0.4	0.4
	Subtotal	**1,015.2**	**1,015.1**	**1,015.3**
15	Pasture	0.9	0.9	0.9
	Alfalfa	51.3	51.4	49.7
	Sugar Beets	4.1	4.1	4.0
	Other Field Crops	51.2	51.3	50.2
	Rice	0.1	0.1	0.1
	Truck Crops	72.0	72.0	71.9
	Tomatoes	3.0	3.0	3.0
	Deciduous Orchard	58.7	58.7	58.7
	Small Grain	41.6	41.9	39.7
	Grapes	121.7	121.7	121.7
	Cotton	275.0	275.7	267.5
	Subtropical Orchard	3.7	3.7	3.7
	Subtotal	**683.3**	**684.5**	**671.1**
Total – All Subregions		**2,125.4**	**2,127.0**	**2,110.7**

Source: CH2M Hill, 2000, Table 18.

ALTERNATIVE 2

Alternative 2 involves the application of a tiered pricing structure that differs from the No-Action Alternative in a few ways.

Tiered pricing for the Alternative 2 is based on a rolling five-year average of actual water deliveries, rather than the current contract amount of water. The five-year rolling average of actual deliveries is referred to as Category 1 water. Each contractor may purchase, as available, 80 percent of their Category 1 water at the basic contract rate (Tier 1). The next 10 percent of their Category 1 water (Tier 2) is priced at the midpoint between the basic contract rate and the full-cost rate (as defined in the Reclamation Reform Act). The last 10 percent of their Category 1 water (Tier 3) is priced at the full-cost rate (as defined in the Reclamation Reform Act).

Any difference between the full contract amount of water and the five-year rolling average of actual water deliveries is referred to as Category 2 water. To the extent Category 2 water is available, the contractor may purchase such water at Tier 3 prices.

Table 4.2-4 shows the tiered water rates for each of the three CVPM subregions used for Alternative 2. A key difference between the No-Action Alternative and Alternative 2 is that the Alternative 2 rates shown in Table 4.2-4 are based on 1999 proposed CVP water rates, not the 1992 CVP water rates used in the No-Action Alternative.

Table 4.2-4
CVP Tiered Water Rates Used in Alternative 2
(dollars per acre-foot)

CVPM Subregion	Tier 1	Tier 2	Tier 3
9	$24.79	$55.14	$85.50
10	$31.15	$40.16	$49.16
15	$32.71	$41.91	$51.10

Source: CH2M Hill, 2000, Table 2.

Tier 1 prices in Subregions 9 and 10 are lower in Alternative 2 than in the No-Action Alternative. This difference in price level appears to help offset the more rigorous price structure of Alternative 2.

Another key difference in the analysis of Alternative 2 is the application of blended rates. It is assumed that the contractor will blend the rate of CVP water in any tier or category before selling the water to growers. This differs from the assumption used to assess alternatives in the PEIS, in which contractors were assumed to sell CVP water to growers at tiered rates.

Blended rates were developed for a series of nine water supply sequences:

- **Average-Average:** An average water year following a five-year sequence of average years.
- **Wet-Average:** An average water year following a five-year sequence of wet years.
- **Dry-Average:** An average water year following a five-year sequence of dry years.
- **Average-Wet:** A wet water year following a five-year sequence of average years.
- **Wet-Wet:** A wet water year following a five-year sequence of wet years.
- **Dry-Wet:** A wet water year following a five-year sequence of dry years.
- **Average-Dry:** A dry water year following a five-year sequence of average years.
- **Wet-Dry:** A dry water year following a five-year sequence of wet years.
- **Dry-Dry:** A dry water year following a five-year sequence of dry years.

The blended CVP water rates used for each of the nine sequences described above are shown in Table 4.2-5.

Table 4.2-5
CVP Blended Water Rates Used in Alternative 2
(dollars per acre-foot)

CVPM	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Subregion	Followed by Average			Followed by Wet			Followed by Dry		
9	33.89	24.79	64.53	55.27	33.89	73.22	24.79	24.79	33.89
10	33.85	31.15	42.94	38.01	33.85	44.63	31.15	31.15	33.85
15	35.47	34.55	38.10	36.34	35.47	38.82	33.07	32.71	35.47

Source: CH2M Hill, 2000, Table 2.

Using the blended rates described in Table 4.2-5 and the farm budget assumptions within the CVPM, estimates of irrigated acreage and value of production for primary crops in each CVPM subregion were developed under each of the nine sequences described above. To determine the impacts of Alternative 2, as compared to the No-Action Alternative, sequences ending in an Average, Wet, or Dry year are compared to the Average, Wet, or Dry year No-Action Alternative results, respectively.

Table 4.2-6 presents the change in irrigated acreage from the No-Action Alternative by primary crop and CVPM subregion in average, wet, and dry years. As can be seen in Table 4.2-6, the majority of impacts, adverse and beneficial, are experienced in CVPM

Subregion 9. The largest beneficial impact to the Delta-Mendota Canal Unit as a whole is a 3,000-acre increase (0.2 percent) in total irrigated acreage during a dry year. The largest adverse impact to the Delta-Mendota Canal Unit is a 1,600-acre decrease (0.1 percent) in total irrigated acreage during a wet year.

Table 4.2-7 presents the change in the value of production from the No-Action Alternative by primary crop and CVPM subregion in average, wet, and dry years. As can be seen in Table 4.2-7, the majority of impacts, adverse and beneficial, are experienced in CVPM Subregion 9. The largest beneficial impact to the Delta-Mendota Canal Unit as a whole is a $1.2 million (less than 0.1 percent) increase in total value of production during a dry year. The largest adverse impact to the Delta-Mendota Canal Unit is a $1.0 million decrease (less than 0.1 percent) in total value of production during an average year that follows a dry five-year period.

Table 4.2-8 presents the change in net farm revenues from the No-Action Alternative by CVPM subregion in average, wet, and dry years. As can be seen in Table 4.2-8, the largest beneficial impact to the Delta-Mendota Canal Unit as a whole is a $2.2 million increase in net farm revenues during a dry year that follows a dry five-year period. The largest adverse impact to the Delta-Mendota Canal Unit as a whole is a $700,000 decrease in net farm revenues during a wet year that follows a wet five-year period.

CUMULATIVE IMPACTS

Cumulative impacts on a CVP-wide basis are addressed in the CVPIA PEIS. Beyond those cumulative impacts, there are no additional impacts attributable to Alternative1 or 2 that would contribute to cumulative agricultural impacts.

Table 4.2-6
Change in Irrigated Acreage from No-Action Alternative by CVPM Subregion and Crop Resulting from Implementation of Alternative 2
(thousands of acres)

CVPM Subregion	Crop Category	Change Compared to Average Year No-Action Alternative			Change Compared to Wet Year No-Action Alternative			Change Compared to Dry Year No-Action Alternative		
		Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
		Followed by Average			Followed by Wet			Followed by Dry		
9	Pasture	-0.2	-0.2	-0.1	-0.4	-0.4	-0.4	0.7	0.7	0.7
	Alfalfa	-0.1	-0.1	0.0	-0.3	-0.3	-0.2	0.4	0.4	0.4
	Sugar Beets	0.0	0.0	0.0	-0.1	-0.1	0.0	0.1	0.1	0.1
	Other Field Crops	-0.2	-0.2	-0.2	-0.5	-0.5	-0.5	0.7	0.7	0.7
	Rice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Truck Crops	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Tomatoes	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
	Deciduous Orchard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Small Grain	-0.1	-0.1	-0.1	-0.3	-0.3	-0.3	1.0	1.0	1.0
	Grapes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	-0.6	**-0.6**	**-0.4**	**-1.6**	**-1.6**	**-1.4**	**3.0**	**3.0**	**3.0**
10	Pasture	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0
	Alfalfa	0.0	0.0	-0.3	-0.1	0.0	-0.1	0.0	0.0	0.0
	Sugar Beets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Field Crops	0.0	0.0	-0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Rice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Truck Crops	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Tomatoes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Deciduous Orchard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Small Grain	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
	Grapes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cotton	0.0	0.0	-0.5	-0.1	0.0	-0.1	0.0	0.0	0.0
	Subtropical Orchard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.0**	**0.0**	**-1.1**	**0.0**	**0.0**	**-0.1**	**0.0**	**0.0**	**0.0**
15	Pasture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Alfalfa	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0
	Sugar Beets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Field Crops	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Rice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Truck Crops	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Tomatoes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Deciduous Orchard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Small Grain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Grapes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cotton	0.0	0.0	-0.2	0.0	0.0	-0.1	0.0	0.0	0.0
	Subtropical Orchard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total – All Subregions		**-0.6**	**-0.6**	**-1.5**	**-1.6**	**-1.6**	**-1.5**	**3.0**	**3.0**	**3.0**

Source: CH2M Hill, 2000, Table 17.

Table 4.2-7
Change in Value of Production from No-Action Alternative by CVPM Subregion and Crop Resulting from Implementation of Alternative 2
(millions of dollars)

CVPM Subregion	Crop Category	Change Compared to Average Year No-Action Alternative			Change Compared to Wet Year No-Action Alternative			Change Compared to Dry Year No-Action Alternative		
		Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
		Followed by Average			Followed by Wet			Followed by Dry		
9	Pasture	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.1	0.1	0.1
	Alfalfa	-0.1	-0.1	0.0	-0.1	-0.1	-0.1	0.2	0.2	0.2
	Sugar Beets	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
	Other Field Crops	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	0.3	0.3	0.3
	Rice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Truck Crops	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
	Tomatoes	0.0	0.0	0.0	-0.1	-0.1	0.0	0.1	0.1	0.1
	Deciduous Orchard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Small Grain	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.3	0.3	0.3
	Grapes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**-0.2**	**-0.2**	**-0.1**	**-0.6**	**-0.6**	**-0.5**	**1.2**	**1.2**	**1.2**
10	Pasture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Alfalfa	0.0	0.0	-0.2	-0.1	0.0	-0.1	0.0	0.0	0.0
	Sugar Beets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Field Crops	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
	Rice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Truck Crops	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
	Tomatoes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Deciduous Orchard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Small Grain	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0
	Grapes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cotton	0.0	0.0	-0.5	-0.1	0.0	-0.1	0.0	0.0	0.0
	Subtropical Orchard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.0**	**0.0**	**-0.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
15	Pasture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Alfalfa	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
	Sugar Beets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Field Crops	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Rice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Truck Crops	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Tomatoes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Deciduous Orchard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Small Grain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Grapes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cotton	0.0	0.0	-0.2	0.0	0.0	-0.1	0.0	0.0	0.0
	Subtropical Orchard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	**0.0**	**0.0**	**-0.1**	**0.0**	**0.0**	**-0.1**	**0.0**	**0.0**	**0.0**
Total – All Subregions		**-0.2**	**-0.2**	**-1.0**	**-0.6**	**-0.6**	**-0.6**	**1.2**	**1.2**	**1.2**

Source: CH2M Hill, 2000, Table 18.

Table 4.2-8
Change in Net Farm Income from No-Action Alternative by CVPM Subregion
Resulting from Implementation of Alternative 2
(millions of dollars)

CVPM Subregion	Cause of Net Revenue Change	Change Compared to Average Year No-Action Alternative			Change Compared to Wet Year No-Action Alternative			Change Compared to Dry Year No-Action Alternative		
		Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
		Followed by Average			Followed by Wet			Followed by Dry		
9	Fallowed Land	-0.1	-0.1	0.0	-0.1	-0.1	-0.1	0.2	0.2	0.2
	Groundwater Pumping	0.6	0.6	0.6	1.2	1.2	1.2	0.3	0.3	0.3
	Irrigation Cost	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	CVP Water Cost	-1.2	-1.2	-1.2	-2.0	-2.0	-2.0	-0.5	-0.5	-0.5
	Higher Crop Prices	0.0	0.0	0.5	0.0	0.0	0.2	0.0	0.0	0.0
	Net Change	-0.4	-0.4	0.1	-0.7	-0.7	-0.5	0.4	0.4	0.3
10	Fallowed Land	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
	Groundwater Pumping	0.0	0.0	6.8	8.3	0.8	8.6	-0.1	-0.1	-0.1
	Irrigation Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CVP Water Cost	0.1	-0.4	-6.3	-7.9	-0.7	-8.1	-0.2	-0.2	0.1
	Higher Crop Prices	0.0	0.0	0.4	0.0	0.0	0.2	0.0	0.0	0.0
	Net Change	0.1	-0.4	0.8	0.5	0.1	0.7	-0.3	-0.3	0.0
15	Fallowed Land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Groundwater Pumping	0.0	0.0	0.0	-0.3	-0.3	-0.3	1.5	1.5	1.5
	Irrigation Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CVP Water Cost	0.3	0.2	0.4	0.2	0.2	0.3	0.4	0.4	0.5
	Higher Crop Prices	0.0	0.0	0.4	0.1	0.0	0.2	0.0	0.0	0.0
	Net Change	0.3	0.2	0.8	-0.1	-0.1	0.2	1.9	1.9	1.9
Total – All Subregions		**0.0**	**-0.6**	**1.7**	**-0.3**	**-0.7**	**0.4**	**2.0**	**2.0**	**2.2**

Source: CH2M Hill, 2000, Table 19.

SECTION 4.3: SOCIOECONOMICS/POWER RESOURCES

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on the socioeconomic resources of the Delta-Mendota Canal Unit. Methods of analysis are described below.

AFFECTED ENVIRONMENT

Socioeconomic analyses are comprised of two primary types of analyses. Regional economics looks at changes to the income and employment levels of the study area. Social analyses look at changes to the demographic or social makeup and well-being of the project area.

Renewal of the long-term contracts could potentially affect the following economic and social resources:

- Regional income
- Regional employment
- Regional population
- Area demographics

The project area includes the geographic service areas of the CVP water contractors within the Delta-Mendota Canal Unit, as described in Section 4.1. The contractor service areas all run roughly along the Interstate 5/California Aqueduct corridor from the city of Tracy in San Joaquin County in the north, through parts of Stanislaus and Merced Counties, to the northern portion of Fresno County, just south of U.S. Highway 180, to the south.

Income and employment information from the U.S. Department of Commerce, Bureau of Economic Analysis was available by industry for 1998. In terms of both earnings (as measured by wages and proprietor earnings) and employment, the largest industries in San Joaquin, Stanislaus, Merced, and Fresno Counties were services, retail trade, manufacturing, and government. Total earnings by major industry for each of the four counties are shown in Table 4.3-1. Total employment by major industry for each of the four counties is shown in Table 4.3-2.

Table 4.3-1
1998 Total Earnings by Industry by County[1]
(thousands of dollars)

Industry	County			
	San Joaquin	Stanislaus	Merced	Fresno
Farm Income[2]	327,146	351,101	317,439	554,061
Ag. Services, Foresty & Fishing	143,300	--[3]	90,821	581,149
Mining	12,578	--[3]	888	14,431
Construction	482,184	382,571	95,963	668,436
Manufacturing	975,178	1,099,685	383,958	1,006,513
Transportation & Public Utilities	655,342	341,005	134,501	651,665
Wholesale Trade	389,369	272,639	71,671	616,834
Retail Trade	757,576	625,731	227,704	1,067,575
Finance, Insurance & Real Estate	473,146	239,403	79,922	702,235
Services	1,556,828	1,313,887	357,590	2,578,764
Government	1,393,704	950,288	418,045	2,203,822
Total	**7,166,351**	**5,715,861**	**2,178,502**	**10,645,485**

Source: U.S. Department of Commerce, 1998a.
[1]Includes wages, other labor income, and proprietor income.
[2]Farm income consists of proprietors' income; the cash wages, pay-in-kind, and other labor income of hired farm workers; and the salaries of officers of corporate farms.
[3]Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the total.

Table 4.3-2
1998 Total Employment by Industry by County[1]

Industry	County			
	San Joaquin	Stanislaus	Merced	Fresno
Farm Employment	17,097	14,591	12,086	34,620
Ag. Services, Foresty & Fishing	9,019	–[2]	4,798	41,266
Mining	231	--[2]	52	456
Construction	12,457	11,482	3,074	19,202
Manufacturing	24,259	27,870	13,012	28,847
Transportation & Public Utilities	14,399	7,150	3,597	15,633
Wholesale Trade	10,124	7,400	2,162	16,654
Retail Trade	40,824	36,143	13,439	60,941
Finance, Insurance & Real Estate	16,800	10,748	4,161	25,906
Services	63,495	51,209	15,353	98,520
Government	34,714	24,152	12,506	56,770
Total	**243,689**	**201,613**	**84,240**	**398,815**

Source: U.S. Department of Commerce, 1998b.
[1]Includes full-time labor, part-time labor, and proprietor employment.
[2]Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the total.

Agriculture is also a very important industry. If taken together, the farm and agricultural service sectors are particularly important to Fresno and Merced Counties. Agriculture takes on additional significance because it is generally considered a “primary” industry (along with mining and manufacturing). A reasonably large portion of activity in nonprimary industries can be attributed to support for primary industry activity in an area. Changes in primary industry activity, therefore, usually precipitate additional changes in nonprimary, or support, industries.

Population data can be most closely related to the project area by aggregating individual census tract information. Population and ethnicity breakdowns were available by census tract for 1990, the most recent reported census. The California Department of Finance develops population and ethnicity estimates and projections at the county level. Implied growth rates from the California Department of Finance’s county estimates were applied to the 1990 tract information to generate estimates and projections from 1990 through 2026 for the aggregated tracts. The following census tracts were used to simulate the Delta-Mendota Canal Unit’s service area.

Fresno County:	Tracts 39, 82, 84.01, 84.02.
Merced County:	Tracts 20, 21.98.
Stanislaus County:	Tracts 32, 33.98, 34.98, 35.
San Joaquin County:	Tracts 52.02, 52.03, 52.04, 52.05, 53.02, 53.03, 53.05, 53.06, 54.02, 55.

Table 4.3-3 shows the estimated and projected population and ethnicity in the Delta-Mendota Canal Unit service area. As shown in Table 4.3-3, the Hispanic community makes up a large proportion of the regional population. It is estimated that over 40 percent of the regional population is identified as Hispanic in 2001 and that the percentage rises to over 50 percent by 2026.

In addition to the information provided above, regional income, employment, and population can be impacted by changes to the availability, cost, or profitability of agricultural resources, recreational resources, power resources, and M&I water resources. Agricultural and recreational resources are discussed in their own sections within this chapter and the reader is referred to those sections for a review of the affected environment of those resources.

Table 4.3-3
Population and Ethnicity–Delta-Mendota Canal Unit Project Area[1]

Year	Population				
	White	Black	Other	Hispanic[2]	Total[3]
1990	69,542	2,257	21,885	35,995	93,684
1995	72,173	2,504	28,136	42,177	102,777
2000	75,774	2,802	33,601	48,500	112,883
2005	80,395	3,142	41,109	56,592	125,813
2010	85,226	3,531	47,514	65,062	139,339
2015	89,462	3,992	53,488	73,896	152,634
2020	93,940	4,417	60,688	85,069	167,985
2026	97,300	4,863	68,221	97,246	184,078

Source: U.S. Census Bureau, 1990.
[1]Estimated and extrapolated from aggregated census tract data.
[2]Hispanic population is also counted as White, Black, or Other.
[3]Equals the sum of White, Black, and Other.

ENVIRONMENTAL CONSEQUENCES

This section describes the environmental impacts of the action alternatives as compared to the No-Action Alternative. Impacts are identified by comparing program components of each action alternative to the No-Action Alternative. The project alternatives are described more fully in Chapter 2.

NO-ACTION ALTERNATIVE

The No-Action Alternative provides a base condition for comparing the action alternatives and represents future conditions at a projected level of development without implementation of either action alternative. The No-Action Alternative reflects the conditions that are expected to be present upon implementation of the Preferred Alternative from the CVPIA PEIS.

Under No-Action Alternative conditions, population and ethnicity projections are equal to the 2026 projections shown in Table 4.3-3. It is assumed that relative income and employment levels do not differ substantially from existing conditions, if adjusted for inflation. Agricultural and recreational resources under No-Action Alternative conditions are described in their respective sections.

It is expected that the CVP will continue to provide an important power resource to municipalities and utility districts in the Delta-Mendota Canal Unit project area. A more detailed description of CVP power resources is available in the CVPIA PEIS. M&I water deliveries would continue to be provided from the CVP. Under average water conditions, 704,000 acre-feet of M&I water is expected to be delivered from the CVP to contractors in the San Joaquin River region (CH2M Hill, 2000, Table 22). Under dry water conditions, 656,000 acre-feet of M&I water is expected to be delivered from the CVP to contractors in the San Joaquin River region (CH2M Hill, 2000, Table 22).

ALTERNATIVE 1

Alternative 1 involves a tiered pricing program that is based on the full current contract amount of water. Socioeconomic resource use resulting from this alternative is assumed to be similar to the the No-Action Alternative because, as described in Table 2-1, the amount of water delivered, the timing of those deliveries, and the rates and method of payment for water delivered under Alternative 1 do not substantially differ from the No-Action Alternative.

ALTERNATIVE 2

Alternative 2 involves the application of a tiered pricing structure that is based on a rolling five-year average of actual water deliveries, rather than the current contract amount of water.

A regional economic analysis for four different regions was developed in the April 24, 2000 Technical Memorandum (CH2M Hill, 2000), which is included as Appendix A. The region used for this assessment is the San Joaquin River region. The Delta-Mendota Canal Unit is included within the San Joaquin River region. Impacts to this region may overstate the impacts to the Delta-Mendota Canal Unit service area because the region encompasses a geographic area that includes, but is larger than, the Delta-Mendota Canal Unit service area.

The regional economic analysis identifies long-run direct and indirect income and employment impacts that would be expected to result from the implementation of Alternative 2. Direct impacts result from changes in agricultural production and profitability and from changes in the cost of M&I water. Had there been any changes in the cost or delivery of CVP power or impacts to recreational resources, such impacts would also have been direct. Indirect impacts are those impacts to the regional economy that occur to other economic sectors (e.g., trade, services, manufacturing) because of the direct impacts.

As noted above, there are no impacts to recreational resources or power resources because CVP facilities are required to be operated in the same manner, no matter how much agricultural or M&I water is actually diverted for use. Reservoir levels will be similar and conveyance facilities will continue to have similar water flows. This allows recreational resources to continue to be used at similar levels (see Section 4.12, Recreational Resources, for a thorough discussion). It also allows CVP hydroelectric facilities to operate at the same level, maintaining the same production and price levels that would be seen under the CVPIA PEIS Preferred Alternative (No-Action Alternative conditions).

The M&I water use economics analysis developed in the April 24, 2000 Technical Memorandum assumes that M&I users can afford the calculated water costs that are described in the CVPIA PEIS. Therefore, CVP water deliveries do not change for the M&I analysis. Additional costs for M&I water are incurred, however. In an average water year, additional costs of $5.2 million are incurred under Alternative 2 (in the entire San Joaquin River region). In a dry water year, no additional costs are incurred under Alternative 2.

Since the Input-Output model used in the regional economic analysis developed in the April 24, 2000 Technical Memorandum assumes a long-run equilibrium is reached, it is only appropriate to compare Alternative 2 impacts to average No-Action Alternative conditions. In addition, the only hydrologic sequence that truly reflects long-run conditions is the five-year average followed by an average year. The five-year dry period followed by an average year is also examined because, while it is not strictly a long-run scenario, some regions can be permanently impacted by a five-year series of drought years. Because of this, the results can be considered long-run.

Under the Average-Average hydrologic sequence discussed in Section 4.2, Agriculture, total employment decreases by 120 jobs and income from profits and wages decreases by $4.2 million. Table 4.3-4 shows the direct and total (direct plus indirect) regional economic impacts to the San Joaquin River region under the Average-Average hydrologic sequence.

Under the Dry-Average hydrologic sequence, total employment decreases by 420 jobs and income from profits and wages decreases by $12.4 million. Table 4.3-5 shows the direct and total (direct plus indirect) regional economic impacts to the San Joaquin River region under the Dry-Average hydrologic sequence.

Population impacts can be expected to occur as a result of the implementation of Alternative 2. The key drivers in determining changes in population are birth rates, death rates, and employment. Alternative 2 will not precipitate any changes in birth or death rates, but as shown in Tables 4.3-4 and 4.3-5, employment impacts will occur.

Table 4.3-4
Regional Economic Impacts on All Sectors for the Average-Average Hydrologic Sequence Compared to the No-Action Alternative Average Conditions–San Joaquin River Region

Impact Resulting from:	Employment (number of jobs)		Income[1] (millions of $)	
	Direct	Total	Direct	Total
Change in Agricultural Output	0	0	-0.1	-0.2
Change in Agricultural Net Income	20	40	0.5	1.0
Change in M&I Water Costs	-80	-150	-206	-5.1
Total[2]	**-60**	**-120**	**-2.2**	**-4.2**

Source: CH2M Hill, 2000, Table 23.
[1]Includes income from wages and profits.
[2]May differ from sum of elements because of rounding.

Table 4.3-5
Regional Economic Impacts on All Sectors for the Dry-Average Hydrologic Sequence Compared to the No-Action Alternative Average Conditions–San Joaquin River Region

Impact Resulting from:	Employment (number of jobs)		Income[1] (millions of $)	
	Direct	Total	Direct	Total
Change in Agricultural Output	-10	-20	-0.3	-0.7
Change in Agricultural Net Income	-140	-240	-3.0	-6.5
Change in M&I Water Costs	-80	-150	0.0	0.0
Total[2]	**-230**	**-420**	**-5.9**	**-12.4**

Source: CH2M Hill, 2000, Table 27.
[1]Includes income from wages and profits.
[2]May differ from sum of elements because of rounding.

If we assume the same ratio of employment to population is present at the county level and within the San Joaquin River region, we can estimate expected changes in population. Using the same data source that was used for Table 4.3-1 (U.S. Department of Commerce, 1998a), the 1998 population for the area encompassing San Joaquin, Stanislaus, Merced, and Fresno Counties is 1,928,868. From Table 4.3-2, total employment in 1998 can be calculated as 928,357 for the area encompassing all four counties. With this information, a population-to-employment ratio of 2.08 is calculated. If this ratio is applied to the total employment losses in Table 4.3-4, the expected impact is a loss of 250 persons (2.08 × 120). If this ratio is applied to the total employment losses in Table 4.3-5, the expected impact is a loss of 873 persons (2.08 × 420).

Impacts are presented for the San Joaquin River region as a whole. As with all impacts within a project area, the concentration of impacts to a smaller geographic area within the project area increases the relative impact, while a more uniform dispersion of impacts across the project area decreases the relative impact. While it is highly unlikely that all identified impacts would present themselves within a single water district or community, it is just as unlikely that a fully uniform dispersion of impacts across the entire project area would occur.

To the extent that income, employment, and population impacts are concentrated in a smaller geographic area, impacts to local tax bases and public services may also be exacerbated. While a lower population would lessen the strain on current public services to meet the needs of their service area, the loss of income would cause a corresponding decrease in local tax revenues used to provide such public services (e.g., police and fire protection, schools, and health services).

In addition, more localized employment impacts could also translate into a disproportionate impact on specific groups such as minority or rural populations.

CUMULATIVE IMPACTS

Cumulative impacts on a CVP-wide basis are addressed in the CVPIA PEIS. Beyond those cumulative impacts, there are additional impacts attributable to Alternative 1 or 2 that would contribute to cumulative socioeconomic impacts.

SECTION 4.4: LAND USE

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on land uses within the Delta-Mendota Canal Unit. Information in this section was summarized primarily from the Final PEIS (Reclamation and Service, 1999), county general planning documents, CVP contractor Water Conservation Plans, U.S. Bureau of the Census data on population, and information obtained in interviews with individual contractors.

AFFECTED ENVIRONMENT

Land use can be defined as the human use of land resources for various purposes including economic production, natural resources protection, recreation, or institutional uses. Land uses are frequently regulated by management plans, policies, ordinances, and regulations that determine allowable uses. This section discusses lands in the project area at the county level and for the geographic service areas of the 20 contractors in the Delta-Mendota Canal Unit. A discussion of areas of Important Farmland is also included.

COUNTY LAND USES

As discussed in the PEIS, the Delta-Mendota Canal Unit contractors are located in the San Joaquin River Region. Land uses could be affected in San Joaquin, Stanislaus, Merced, and Fresno Counties. The following discussion generally addresses lands located within these counties.

San Joaquin County

San Joaquin County encompasses approximately 1,440 square miles and includes the seven incorporated cities of Stockton, Tracy, Manteca, Escalon, Ripon, Lodi, and Lathrop. Stockton and Tracy are the largest cities in the county. The City of Tracy is the only CVP contractor in the Delta-Mendota Canal Unit that is a municipality and uses its CVP supply solely for M&I use.

Demographics. In 1990, it was estimated that more than 77 percent of the county's population resided within the seven incorporated cities, with the additional 23 percent residing within urban and rural unincorporated areas (San Joaquin County General Plan, 1992). The population in San Joaquin County is expected to increase from about 465,000 in 1990 to about 750,000 by the year 2010 or to increase on average by about 14,000 persons per year (San Joaquin County, 1992). In 1999, the California Department of Finance estimated the county's population to be nearly 545,000 (San Joaquin County, 2000).

Land Use. In 1990, approximately 86 percent of the county's total acreage was used for agriculture. The existing land uses in San Joaquin County are shown in Table 4.4-1.

Table 4.4-1
San Joaquin County Land Uses

Land Use	Acres	Percentage of County
Agriculture	788,896	86.47
Urban*	63,760	6.99
Other Land	49,332	5.41
Water	10,341	1.13
Total	**912,329**	**100.00**

* Includes residential, commercial and industrial

Source: Final Environmental Impact Report (San Joaquin County, 1992)

San Joaquin County contains large areas of highly productive soils. Agriculture and related activities have, therefore, historically constituted a major portion of the county's economic base. Agriculture has been a mainstay of the county's economy. According to the 1997 Agricultural Census for San Joaquin County, there were 808,838 acres in farms; this represents a decrease from 823,729 acres in 1987. It is estimated that with projected population growth and continued urbanization in the county that the amount of agricultural land lost could increase from the 10 percent loss over the last 50 years to a 33 percent loss by the year 2040 (San Joaquin County, 2000).

Stanislaus County

Stanislaus County encompasses an area of approximately 1,500 square miles and includes the nine incorporated cities of Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock, and Waterford. Modesto and Turlock are the largest cities in the county.

Demographics. In 1990, an estimated 74 percent of the population lived in incorporated areas, an increase from 65 percent in 1980 (Stanislaus County, 1994). Based on U.S. Bureau of the Census data, the population in Stanislaus County increased by 39 percent in the 1980s from 265,900 to 370,522. This compared to the average increase statewide of 26 percent. Between 1980 and 1990, the population in Stanislaus County increased by 59 percent in incorporated cities, while the unincorporated areas saw an increase of only 3 percent. Since 1990, the county's population has continued to grow at an average annual rate of 3.5 percent, reaching a total population of 412,676 in 1994 (Stanislaus County, 1994). According to the U.S. Bureau of the Census, the population in the county in 1997 was 421,818.

Land Use. Stanislaus County has adopted community plans for most of the unincorporated towns in the county. These plans outline land uses and future growth patterns of the towns and are used in conjunction with county general planning documents. For unincorporated areas not included in a community plan, land use designations generally include residential, commercial, industrial, agricultural, urban transition, and industrial transition. Over 95 percent of the area in the unincorporated county is zoned for agricultural use.

The incorporated cities in the county have adopted city general plans. Approximately 25,054 acres of farmland lie within existing city spheres of influence (Stanislaus County, 1992). Specific land use information is available from community and city general plans.

General countywide land use information is not readily available in the Stanislaus County General Plan. However, the plan does state that urban development has spread over 48,000 acres, much of which was originally prime farmland in agricultural production. According to the 1997 Agricultural Census for Stanislaus County, there were 732,736 acres in farms; this represents a decrease from 819,845 acres in 1987.

Merced County

Merced County encompasses approximately 2,020 square miles and includes the six incorporated cities of Atwater, Dos Palos, Gustine, Livingston, Los Banos, and Merced and 18 unincorporated communities. Merced is the largest incorporated city in the county.

Demographics. From 1980 to 1990, the population in Merced County grew by over 33 percent from 134,560 to 178,403. This is compared to the average increase statewide of 26 percent. The incorporated cities grew by approximately 41 percent and the unincorporated areas by 19 percent. According to the U.S. Bureau of the Census, the population in Merced County in 1996 was 194,407.

Land Use. Merced County uses the “Urban Centered Concept” as a basic land use principle. This concept directs urban development in identified centers. Increased growth often results in a loss of the most productive agricultural soils. Under this concept, however, urban development will only occur within cities, unincorporated communities, and other urban centers. In Merced County, besides the urban areas discussed above, rural areas of the county, which are typically used for cropping or pasturing activities, are subject to their own land use designations. When the general plan was developed in 1990, it was estimated that 80 percent of the population lived in the urban centers, the remaining 20 percent lived in rural areas, and 95 percent of the land in the county was considered rural. General countywide land use information is not readily available in the Merced County General Plan.

According to the 1997 Agricultural Census for Merced County, there were 881,696 acres in farms, a decrease from 1,049,302 acres ten years earlier.

Fresno County

Fresno County encompasses nearly 6,000 square miles and includes the 15 incorporated cities of Coalinga, Clovis, Firebaugh, Fowler, Fresno, Huron, Kerman, Kingsburg, Mendota, Orange Cove, Parlier, Reedley, San Joaquin, Sanger, and Selma. Over 60 percent of the population resides in the county's two largest cities, Fresno and Clovis.

Demographics. According to Department of Finance population estimates, between 1980 and 1990, the population in Fresno County grew by approximately 29 percent from 514,621 to 661,400. This is compared to the average statewide increase of 26 percent. According to the U.S. Bureau of the Census, the population in Fresno County in 1997 was 754,396. The combined populations of Fresno and neighboring Clovis comprise 61 percent of the total county population and 82 percent of the population of the other incorporated cities combined (County of Fresno, 2000a).

Land Use. In 1997, approximately 50 percent of the county's total acreage was used for agriculture. The existing land uses in Fresno County are shown on Table 4.4-2.

Table 4.4-2
Fresno County Land Uses
(1997)

Land Use	Square Miles
Residential	152
Commercial	7
Industrial	11
Agricultural	2,911
Resource Conservation[1]	2,691
Unclassified[2]	11
Incorporated Cities	154
Total	**5,937**

[1]Including national forests, parks and timber preserves
[2]Includes streets, highways and rivers

Source: Fresno County General Plan/Fresno County Perspectives on the Year 2020: Economic and Growth Scenarios (1998)

Farming and agriculture-related businesses comprise a major component of the local economy. Factors that contribute to its success include excellent soil and climatic growing conditions and workforce and transportation availability. According to the 1997

Agricultural Census for Fresno County, there were 1,881,418 acres in farms; this represents a decrease from 1,975,373 acres in 1987.

CVP CONTRACTORS

As discussed in Section 4.1, 20 contractors receive CVP water from the Delta-Mendota Canal. The following discussion provides information on land uses for each contractor as well as a discussion of current agriculture and future trends in agriculture as applicable. The figures included at the end of Section 4.1 display the current land uses for those contractors discussed below.

Banta-Carbona Irrigation District

Banta-Carbona Irrigation District is entirely an agricultural district and currently does not supply any water for M&I use. It is anticipated that as the City of Tracy and the Interstate 5 corridor continue to grow, some areas currently within the district may be detached and annexed to the City of Tracy. Also, new areas that may require water for M&I purposes would be detached from the district. Currently, a few parcels within the district are targeted for detachment and would be annexed to the City of Tracy. Whenever a new urban expansion is planned, the land is automatically deleted from district boundaries. Banta-Carbona Irrigation District has informed Reclamation of its plan to transfer a portion of its CVP supply to the City of Tracy by 2025. Therefore, while vulnerable to development pressures along the Interstate 5 corridor, Banta-Carbona Irrigation District is expected to remain an entirely agricultural district.

The district was considered built-out in 1968 following underground pipeline completion made possible with funds from a PL 84-984 federal assistance loan. As the City of Tracy has continued to expand, some of these existing facilities will be abandoned. Currently, some portions of the district's distribution system remain unused. When an area is detached from the district, the water that was used to serve the land remains with the district.

There are about 600 to 700 landowners in the district with 60 to 70 water customers. There are fewer agricultural water customers than landowners because many of the landowners lease their land to the same farmers who farm larger areas to make their activities more profitable. Major crops being produced within the district include both row crops (cannery tomatoes, dry beans, alfalfa, and a small quantity of melons) and permanent crops (primarily almonds, with smaller amounts of walnuts, apricots, peaches, and apples). Also, some areas have been planted with grapes over the last few years. Irrigation methods include furrow, open ditch or border flooding, and siphon pipe on row crops and sprinklers on permanent crops. Two small sections of land are fallowed this growing season; however, the reason is not known.

Broadview Water District

Currently, there are 18 farmers in the Broadview Water District with farms that range in size from approximately 238 acres to 1,280 acres. Most of the farmers in the district lease the land from absentee landowners. Broadview Water District is almost entirely an agricultural district. The only CVP water used for M&I use is 23 acre-feet, which is used as the drinking water source in the district. The drinking water serves both Broadview Water District buildings and a small number of residents. Because Broadview Water District is located in a rural area away from major development pressures, the conversion from agricultural to M&I uses is unlikely.

Cropping patterns in the district have remained stable. The entire district is planted in row crops with approximately one-half of the district producing cotton. Other crops include seed alfalfa, tomatoes, and melons. There are no permanent crops in the district because of shallow groundwater levels. Irrigation methods include primarily furrow and gated pipe, with a smaller number of acres on sprinklers. This year, about 600 to 700 acres are not in production; included in this total are 550 acres that remained fallow because the water rights were transferred off the land.

Centinella Water District

The Centinella Water District, an entirely agricultural district, is 840 acres in size and has only one landowner. All CVP water is used for agricultural uses. Because Centinella Water District is located in a rural area away from major development pressures, the conversion from agricultural to M&I uses is unlikely.

While Del Puerto Water District provides the administrative functions for the district, Centinella Water District has its own CVP contract. For this current year, all of the 295 acres of almond orchards in the district are being irrigated with sprinklers.

City of Tracy

All CVP water received by the City of Tracy is used for M&I purposes. As urban growth continues both in Tracy and along the Interstate 5 corridor, urbanization would likely continue to expand into neighboring water districts. It is expected that some lands located in neighboring The West Side Irrigation District, Plain View Water District, and Banta-Carbona Irrigation District may detach from their respective districts and be annexed to the City of Tracy. Once annexed, the City of Tracy will be responsible for fulfilling all water supply needs. To meet growing water demands, the City of Tracy is actively pursuing additional surface water supplies in the form of permanent water transfers. The West Side Irrigation District is currently working with the City of Tracy to permanently transfer 5,000 acre-feet (2,500 acre-feet initially, with another 2,500 acre-feet in five years) of CVP supply for M&I use to help meet the city's growing demand. The South County Surface

Water Project is also expected to supply 10,000 acre-feet of treated surface water supply to the City of Tracy. The source of this additional supply is the Stanislaus River. The new supply would require the construction of a new water treatment plant and pipelines to transport the water. It is expected that this new source could begin to serve the City of Tracy by 2004. Banta-Carbona Irrigation District and Plain View Water District have also informed Reclamation of their plan to transfer a portion of their CVP supplies to the City of Tracy by 2025.

A large portion of the development in Tracy will be residential in nature; however, an increase in industrial and commercial development is also anticipated. Fueling the growth in the area is low land prices, expansion out of the San Francisco Bay Area, and freeway access.

Coehlo Family Trust

The portion of the Coehlo Family Trust property under contract with Reclamation for the delivery of CVP water is 1,120 acres in size. Row crops grown on the property this year include primarily cotton, with smaller quantities of wheat, garlic, and cannery tomatoes. Permanent crops include table grapes.

The Coehlo Family Trust property is located in the area of the Interstate 5 Business Development Corridor. The Interstate 5 Business Development Corridor is a rural partnership for Central California commerce and is formed by a coalition of the cities of Firebaugh, Mendota, Kerman, and San Joaquin and the unincorporated community of Tranquillity, in western Fresno County. The group has a goal of working as a cooperative association to attract business and industrial development and new jobs to the area. The area is currently experiencing small amounts of growth; however, this growth is not expected to affect the Coehlo Family Trust property operations in the short term. Growth in this portion of Fresno County is considered minor compared to the major growth pressures experienced along Interstate 5 near the cities of Patterson and Tracy.

Del Puerto Water District

Del Puerto Water District is primarily an agricultural district. Currently, the only CVP supply used for M&I purposes is the one acre-foot of water supplied to the city landfill each month for dust suppression. All remaining CVP supplies are used for agriculture. Despite the urban sprawl in the area resulting from the growth of Patterson and Tracy and along the Interstate 5 corridor, Del Puerto Water District would like to continue to remain primarily an agricultural district. Del Puerto Water District does not intend to increase the amount of CVP water used for M&I purposes.

There are about 170 water users in the district. More than 30 different crops have been grown commercially in the district over the years. Principal crops grown in 1999 included row crops (cannery tomatoes, alfalfa, large limas, and dry beans). However, almost one-half of the agricultural production in the district is permanent crops (almonds, apricots, and walnuts). Typical irrigation methods in the district include primarily furrow irrigation for row crops and sprinkler, sprinkler with less frequent use of drip, and micro-misters for permanent crops. In 1999, 5,880 of the 45,068 acres in the district were left fallow.

Eagle Field Water District

Eagle Field Water District is entirely an agricultural district. Because it is located in a rural area away from major development pressures, the conversion from agricultural to M&I uses is unlikely. The crops being produced in the district this year are cotton, cannery tomatoes, and rice. In the past, some of the land has also been farmed with sugar beets and dry onions. All administrative functions for the Eagle Field Water District are currently being performed by Panoche Water District.

Fresno Slough Water District

Fresno Slough Water District is entirely an agricultural district and does not supply water for M&I use. It is also located in the area of the Interstate 5 Business Development Corridor, nearest to the town of Tranquillity. While the area is currently experiencing small amounts of growth, this growth is not expected to affect the district's ability to remain entirely an agricultural district.

There are about 10 landowners in the district. Most of those landowners have farmed in the district for a number of years, contributing to its stable landowner base. All of the crops grown in the district are row crops (cotton, seed alfalfa, and sugar beets). There are no permanent crops in the district and no conversion to permanent crops is anticipated. The main reason for the reliance on row crops rather than permanent crops is that soils are typically heavy clays and suitable only for row crops. Irrigation methods in the district include mostly furrow irrigation and a few solid-set sprinklers. This year, about 30 to 40 acres of land have been left fallow because of poor soil quality.

Currently, a 500-acre parcel of land on the northern end of the district is for sale. Potential buyers include the Tranquillity Irrigation District and the California Department of Fish and Game, which is interested in purchasing the land to increase the size of the neighboring refuge area.

James Irrigation District

James Irrigation District is entirely an agricultural district and currently does not supply any water for M&I use. The district is also located in the area of the Interstate 5 Business

Development Corridor and nearest to the city of San Joaquin in Fresno County. While the area is currently experiencing small amounts of growth, this growth is not expected to affect James Irrigation District's ability to remain entirely an agricultural district.

There are approximately 200 farms in James Irrigation District and in 1996, about 23,233 acres of the 26,103-acre district were irrigated. The principal crops grown in the district include cotton and seed alfalfa with smaller amounts of alfalfa hay and tomatoes. Also, a small parcel of land (less than 500 acres) produces barley and wheat in rotation. Soil types in the areas of row crops include heavy Merced clay. Soil types in small areas of the district include light sandy loam soil types; these areas are planted with permanent crops (almonds and grapes). The trend in the district has been a gradual shift from larger farms to smaller family-owned farms. The typical irrigation method in the district is furrow irrigation. Drip irrigation was used for grape crops. Approximately 500 acres of land has remained idle this year because of land foreclosures and landowners that do not want to deal with the administrative burdens of having a lessee.

Laguna Water District

Laguna Water District is entirely an agricultural district with only one landowner. Because it is located in a rural area away from major development pressures, the conversion from agricultural to M&I uses is unlikely. In 1995, the primary crops produced in the district were alfalfa hay, cotton, and a small amount of oats. This year, crops being produced in the district are sugar beets, wheat, cotton, and alfalfa hay. All the land in the district is irrigable agriculture.

Mardelia Hughes Property

The portion of the Mardelia Hughes property under contract with Reclamation for the delivery of CVP water is 10.99 acres in size. The Hughes property is used entirely for agriculture and has one landowner. This year, the entire property is being farmed for seed alfalfa.

The Mardelia Hughes property is located in the area of the Interstate 5 Business Development Corridor. The area is currently experiencing small amounts of growth; however, this growth is not expected to affect the Hughes property operations in the short term.

Mercy Springs Water District

Mercy Springs Water District is entirely an agricultural district. Because it is located in a rural area away from major development pressures, the conversion from agricultural to M&I uses is unlikely. The crops being produced in the district this year include cotton and alfalfa. All administrative functions for the district are currently being provided by Panoche Water District.

Oro Loma Water District

Oro Loma Water District is entirely an agricultural district with only one landowner. Because it is located in a rural area away from major development pressures, the conversion from agricultural to M&I uses is unlikely. The only crop being produced in the district this year is rice. Historically, some of the land had also been farmed with cotton. All administrative functions for Oro Loma Water District are currently being provided by Panoche Water District.

Patterson Irrigation District

Patterson Irrigation District is entirely an agricultural district. The district provides no M&I water. It is anticipated that as Patterson and the Interstate 5 corridor continue to grow, any new proposed development requiring M&I water would be detached from the district. It is currently Patterson Irrigation District policy to require water users requesting M&I water to detach from the district. Therefore, despite neighboring growth pressures, Patterson Irrigation District is expected to remain entirely an agricultural district.

In the last 15 years, the primary crops have included apricots, beans, and alfalfa. Because the district is located in the heart of dairy country, crops like alfalfa will continue to be staple crops. However, there is a continued conversion from these row crops to higher valued permanent crops (almonds). Patterson Irrigation District does not currently maintain detailed records regarding irrigation methods. The best estimates show that the main irrigation methods used between 1986 and 1996 were primarily furrow/border followed by sprinklers and trickle.

Plain View Water District

Plain View Water District is primarily an agricultural district. In 1990, a small portion of the district's CVP supply was allocated for M&I use to service commercial and residential development. The water provided by the district was treated and delivered by the City of Tracy. Since 1990, approximately 500 acres of land have been converted to M&I use. The water allocated for the converted land will continue to be used to serve the new land use through the City of Tracy water supply system. It is possible that as Tracy continues to grow, the amount of CVP water used for M&I purposes could increase. It is also possible that the growth could result in some areas currently within the district being detached and annexed to the City of Tracy. Plain View Water District has also informed Reclamation of its plan to transfer a portion of its CVP supply to the City of Tracy by 2025.

Row crops produced within the district include primarily alfalfa. Permanent crops include almond and cherries. There is also some dry farming in the district. Typical irrigation methods include primarily furrow and border irrigation and sprinklers.

Reclamation District #1606

Reclamation District #1606 has only one lessee and is entirely an agricultural district. Historically, only a small area of the district has been farmed and all but these 50 acres of land remain fallow. On those acres being farmed, cotton is the only crop produced. The other portions of the district are typically used for dry grazing.

Reclamation District #1606 is adjacent to James Irrigation District and near the city of San Joaquin. While the area is currently experiencing small amounts of growth, this growth is not expected to affect Reclamation District #1606's ability to remain entirely an agricultural district.

The West Side Irrigation District

The West Side Irrigation District is divided entirely in half by the City of Tracy and, therefore, is directly impacted by the city's continuing growth. Currently, the district is an agricultural district and does not provide any water for M&I use. The district would prefer to continue to be solely an agricultural district. It is also anticipated that approximately 1,400 acres of the district will be annexed to the City of Tracy over the next few years. It is possible that as the City of Tracy continues to grow, additional acres could be detached from the district.

As discussed previously for the City of Tracy, the district is working with the city to permanently transfer 5,000 acre-feet of CVP supply to meet Tracy's growing demand. This transfer would allow the district to continue to be strictly an agricultural district.

There are about 100 water users within the district. The main crops being produced in the district include alfalfa for hay, cannery tomatoes, and beans. Although there are two small parcels of permanent crops (apricots and walnuts) within the district, the soil in the district is substandard for growing permanent crops and further conversion to permanent crops is not anticipated. Major irrigation types include furrow and border (flood) irrigation. The use of sprinkler irrigation in the district is difficult because of high winds. This year, no historically farmed land is fallow.

Tranquillity Irrigation District

Tranquillity Irrigation District is an agricultural district and currently does not supply water for M&I use. It is also located in the area of the Interstate 5 Business Development Corridor, nearest to the town of Tranquillity. While the area is currently experiencing small amounts of growth, this growth is not expected to affect the district's ability to remain entirely an agricultural district.

Principal crops grown in the district include cotton, seed alfalfa, canning tomatoes, sugar beets, and melons. Over the past few years, about 50 acres of land have been converted from row crops to permanent crops (almonds). The almond trees are still young (at two to three years old); however, it is expected that if they are successful, more land will be converted from row crops to more profitable permanent crops. The district has also experimented with growing small areas of innovative crop types including mustard, bell peppers, and zinnias for seed. It is estimated that 9,270 of the 10,750 acres in the district are irrigated. Typical irrigation for the row crops includes furrow irrigation. Drip systems were also installed for those acres converted to permanent crops. Tranquillity Irrigation District has approximately 100 landowners.

West Stanislaus Irrigation District

West Stanislaus Irrigation District is entirely an agricultural district and currently provides no water for M&I use. Although some land within the district is zoned for industrial use, there are currently no known development plans. It is also the district's policy to remain solely an agricultural district and it requires that any M&I users detach from the district.

Primary crops in the district are row crops (cannery tomatoes, beans, and alfalfa). The district has also continued to see a conversion from row crops to more profitable permanent crops including almonds and grapes. This trend is expected to continue. A portion of the district land is also being used for dairy farms. The typical irrigation methods in the district are furrow irrigation for row crops and drip irrigation or sprinklers for permanent crops. Gated pipe is also used extensively throughout the district for both furrow and border irrigation.

Widren Water District

Widren Water District is approximately 30 acres in size and is entirely an agricultural district with only one landowner. Because it is located in a rural area away from major development pressures, the conversion from agriculture to M&I is unlikely. This year, crops produced in the district include seed alfalfa and sugar beets.

FARMLAND CATEGORIES

Table 4.4-3 contains a description of farmland categories as defined by the U.S. Department of Agriculture, Natural Resources Conservation Service. Some of these farmland categories are found within San Joaquin, Stanislaus, Merced, and Fresno Counties.

Table 4.4-3
Important Farmland Map Categories

Category	Description
Prime Farmland	Land that has the best combination of physical and chemical characteristics for producing food, seed, forage, fiber, and oilseed crops and is also available for use. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods.
Farmland of Statewide Importance	Land other than Prime Farmland that has a good combination of physical and chemical characteristics for crop production. The land must have been used for production of irrigated crops within the last three years and also meet specific criteria including soil temperature and range.
Unique Farmland	Land that does not meet the criteria for either Prime Farmland or Farmland of Statewide Importance, but that is used for the production of specific high economic value crops. It is land that has a special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality of high yield of specific crops.
Farmland of Local Importance	Land that may be important to the local economy because of its productivity.

Source: County of Fresno, 2000b.

Approximately 64 percent of the farmland in San Joaquin County meets the criteria listed in Table 4.4-3. Specifically, according to the preliminary important farmland map prepared by the California Department of Conservation, Farmland Mapping Program, San Joaquin County has approximately 437,910 acres of Prime Farmland, 97,134 acres of Farmland of Statewide Importance, and 49,475 acres of Unique Farmland. The area of Farmland of Local Importance is not available. In 1993, Stanislaus County contained an estimated 617,000 acres of Prime Farmland. The soils in Merced County have also been classified and mapped by the Farmland Mapping Program. There is some farmland in Merced County that meets the above criteria. Although the county general plan includes a map of soils meeting the above criteria, the specific acreages were not included. According to the Department of Conservation, Fresno County has approximately 374,567 acres of Prime Farmland, 144,243 acres of Farmland of Statewide Importance, 96,724 acres of Unique Farmland, and 29,663 acres of Farmland of Local Importance.

REGULATORY SETTING

Williamson Act

The California Land Conservation Act of 1965 (more commonly known as the Williamson Act) established a voluntary tax incentive program for preserving both agricultural and open space lands. The Act reduces property taxes in return for the guarantee that the property will remain in agriculture for not less than 10 years, thereby slowing down the conversion of agricultural land. Under the Act, property owners enter into 10-year contracts with their respective counties. The county then places restrictions on the land in exchange for tax savings. The property is then taxed according to the income it is capable of generating from agriculture and other compatible uses, rather than being taxed on its full market value. The contract is automatically renewed annually after the first 10 years, unless a written request, called a Notice of Non-Renewal, is prepared.

As of July 1991, approximately 71 percent of the land in San Joaquin County was held under Williamson Act contracts. Notices of Non-Renewal have been filed for 7,571 acres whose contractual agreements expire by 2006. Stanislaus County's total acreage covered under Williamson Act contract in fiscal year 1991-1992 was 663,128 acres (this dropped from 723,055 in 1981-1982 and the trend for non-renewal is expected to continue). Merced County also has land in Williamson Act contracts, but the specific number of acres is unknown. In Fresno County, approximately 1,494,454 acres of farmland are within Williamson Act agricultural preserves that are located predominantly in unincorporated areas of the county.

ENVIRONMENTAL CONSEQUENCES

The renewal of the long-term contracts could potentially affect the following:

- Agricultural lands going out of production and remaining fallow, including some Prime or Unique Farmlands
- Agricultural lands being converted to M&I use

As discussed above under Affected Environment, some land in the project area was previously farmed and this year remains fallow. It can be assumed that some of this land also meets the Important Farmland criteria listed in Table 4.4-3. The specific districts that have fallowed land and the amounts and locations of the fallowed land vary during each growing season. There are numerous reasons that land would be fallow including:

- Water deliveries, reliability, and timing and their relation to pre-planting and management decisions and costs
- Water availability
- Water rights being transferred from one parcel of land to another
- Economics, including cost controls, commodity pricing and market conditions
- Foreclosures

- Marginal agricultural land or poor soil conditions

Another reason that land may be fallowed or converted from agriculture to another use is growth pressure. As discussed above, the San Joaquin River Region is experiencing unprecedented growth and considerable development pressures. The Central Valley has become a magnet for those in search of affordable housing within a commuting distance of major employment centers. Specifically, for San Joaquin and Stanislaus Counties, this growth is primarily a result of people who move from the San Francisco Bay Area in a search for affordable housing costs and a highly attractive quality of life. Increased demand for residential property, combined with low prices for agricultural products and rising costs of farming, have created increased pressure for farmers to sell their land for housing developments. As the population increases and development pressures continue, it is expected that a corresponding increase in urban development and a decrease in agricultural lands in production would also continue.

As previously discussed, many of the Delta-Mendota Canal Unit contractors could be directly affected by the increasing growth pressures; specifically those contractors located in San Joaquin and Stanislaus Counties and near the cities of Tracy and Patterson. While it is the policy of most of these districts to remain entirely agricultural districts, this could require an area currently within the district to detach from the district if M&I water is required for development. In the case of some districts, the amount of CVP water used for M&I purposes could increase.

NO-ACTION ALTERNATIVE

As described in Chapter 2, the No-Action Alternative provides a baseline condition for comparing the action alternatives and represents future conditions at a projected level of development without the implementation of any action alternative. Under the No-Action Alternative, long-term contracts would be renewed and contractors would still receive their CVP allocation.

The No-Action Alternative would not directly impact land uses within the project area. The renewal of long-term contracts in the Delta-Mendota Canal Unit would not involve construction of new facilities that would alter current land uses and would not result in the installation of structures that would conflict with existing land use plans.

The long-term renewal of CVP water to the project area would only continue to provide water supplies that accommodate a portion of the planned populations and land uses that are identified in the county general planning documents. The renewal of the long-term contracts would continue the water supply for agricultural production and crop production and, therefore, contribute to the continued production of these lands. Implementation of this alternative would not directly impact the continued production of agricultural crops or impair the productivity of important farmlands.

An indirect impact could occur as more land is fallowed when surface water supplies are unavailable or when deliveries are reduced in response to higher water costs under tiered pricing. Also, alternative surface water and groundwater supplies may become unaffordable because of the factors listed above. It is, however, difficult to attribute a corresponding loss of acreage to the affordability of water.

ALTERNATIVE 1

Similar to the discussion above for the No-Action Alternative, Alternative 1 would not directly result in any adverse impacts to land use. The long-term renewal of CVP water to the project area would only continue to provide water supplies that accommodate a portion of the planned populations and land uses that are identified in the county general planning documents. The renewal of the long-term contracts would continue the water supply for agricultural production and crop production and, therefore, contribute to the continued production of these lands. Implementation of this alternative would not directly impact the continued production of agricultural crops or impair the productivity of important farmlands.

ALTERNATIVE 2

Similar to the discussion above for the No-Action Alternative, Alternative 2 would not directly result in any adverse impacts to land use. The long-term renewal of CVP water to the project area would only continue to provide water supplies that accommodate a portion of the planned populations and land uses that are identified in the county general planning documents. The renewal of the long-term contracts would continue the water supply for agricultural production and crop production and, therefore, contribute to the continued production of these lands. Implementation of this alternative would not directly impact the continued production of agricultural crops or impair the productivity of important farmlands.

CUMULATIVE IMPACTS

Cumulative impacts on a CVP-wide basis are address in the CVPIA PEIS. Beyond those cumulative impacts, there are no additional impacts attributable to Alternative 1 or 2 that would contribute to cumulative land use impacts.

SECTION 4.5: AIR QUALITY

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on the air quality in the area of the Delta-Mendota Canal Unit. Information in this section was summarized from the Draft PEIS, Air Quality, Technical Appendix, Volume 6 (Reclamation, 1997).

AFFECTED ENVIRONMENT

Most of the air pollutants in the area of the Delta-Mendota Canal Unit are associated with both urban and agricultural land uses. In general, four basic land uses occur: irrigated agriculture; dryland agriculture (dry cropped, fallow, idle, or grazed); M&I; and undeveloped (natural). The primary air pollutants associated with all four land uses include particulate matter (PM) and hydrocarbons or organic gases that may serve as ozone (O_3) precursors.

Pollutants commonly associated with agricultural land uses include PM, carbon monoxide (CO), nitrogen oxides (NOx), and O_3 precursors. PM results from field burning, farm operations such as tilling, plowing, and the operation of farm equipment on loose earth, and entrained road dust releases and fuels combustion in vehicles and farm equipment. Particulate emissions may also occur when fallow fields do not have a crop cover to inhibit wind erosion. Co is released to the atmosphere during field burning and fuel combustion in farm equipment. Nitrous oxides are also released during field burning. O_3 precursors are released in farm equipment emissions and during the application of pesticides and fertilizers. The effect of these practices on air quality conditions may be influenced by meteorological conditions, the variability of emissions controls, and the adoption and enforcement of emissions regulations.

Many M&I practices result in hydrocarbon and PM emissions. Sources of hydrocarbon emissions include fuel combustion in vehicles and industrial equipment, painting and solvent use, and residential heating. Sources of PM emissions include dust entrained in pavement, structural and automobile fires, construction and demolition, residential fuel combustion, and fuel consumption in vehicles. CVPIA actions are not anticipated to affect air pollutants associated with relatively minor urban and industrial uses in the Delta-Mendota Canal Unit. Therefore, this section focuses on potential impacts to air quality conditions that would result from changes in agricultural land uses.

The Delta-Mendota Canal Unit is located in the San Joaquin Valley Air Basin (SJVAB), which includes the southern portion of the Central Valley, including the lower slopes of the mountain ranges. The air quality of the SJVAB is regulated by the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD), which includes Merced, Fresno, San

Joaquin, and Stanislaus Counties. The entire SJVAB is designated nonattainment with respect to federal and state O_3 and PM standards, and the urban area of Fresno is nonattainment for federal and state CO standards.

ENVIRONMENTAL CONSEQUENCES

Air quality impacts that could occur are judged to be adverse if the action being evaluated causes or contributes to a violation of federal or state ambient air quality standards; increases exposure of people to air pollution in concentrations in violation of ambient standards, causes pollutant or pollutant precursor emissions in excess of local air quality management agency impact adverse thresholds; or violates federal, state, or local emission limitations for specific pollutants or emission sources. Current federal and SJVUAPCD regulations require that the project alternatives not have an adverse impact on regional air quality, as reflected by the estimated long- and short-term impacts from the direct and indirect emissions sources created by the action. The SJVUAPCD recommends the following thresholds for adverse air quality impacts:

- Reactive organic gases and NOx should not exceed 10 tons/year.
- Complying with SJVUAPCD Regulation VIII reduces potential impacts from PM emissions to less than adverse. Large or high intensity construction projects near sensitive receptors may require mitigation beyond Regulation VIII.
- The project causes or contributes to an exceedance of federal and state ambient CO standards. This is to be determined by screening or modeling.
- The adverse threshold for hazardous air pollutant emissions is based on the potential to increase cancer risk for the person with maximum exposure potential by 10 in one million. The non-cancer Hazard Index must be less than 1. This is to be determined by screening or modeling.
- The adverse threshold for odor impacts is based on distance of the odor source from people and complaint records for the facility or a similar facility. More than one confirmed complaint per year averaged over a three-year period or three unconfirmed complaints per year averaged over a three-3-year period would be an adverse impact.
- Construction impacts have the same thresholds as above, but adverse thresholds apply only during the construction period.

NO-ACTION ALTERNATIVE

In the No-Action Alternative, agricultural land uses would include similar crops and cropping patterns as those described in the Affected Environment. It is assumed that retired or fallowed lands would be reseeded with grasses and grazed by livestock or occasionally dryland-farmed.

As discussed for the No-Action Alternative in Section 4.2, very little change would be seen in either irrigated acreage from average to wet to dry water years. Actively farmed lands and fallowed lands can serve as a source of fugitive air emissions, particulate emissions, and minimal emissions from farm equipment engines. Fugitive dust emissions from irrigated lands are not substantially different from dry-farmed lands or fallow lands with a non-cultivated cover crop (Montgomery Watson, 1995). Furthermore, emissions from farm equipment and transportation of agricultural materials would not substantially increase under the No-Action Alternative. Therefore, the No-Action Alternative would not result in adverse impacts to air quality.

ALTERNATIVE 1

Similar to the discussion above for the No-Action Alternative, Alternative 1 would not result in adverse impacts to air quality. Agricultural land uses would include similar crops and cropping patterns as those described in the Affected Environment. It is assumed that retired or fallowed lands would naturally revegetate, be grazed by livestock, or be occasionally dryland-farmed. Therefore, Alternative 1 would not result in adverse impacts to air quality.

ALTERNATIVE 2

As described in Table 4.2-6, 1,600 total acres could be taken out of production as a result of implementing Alternative 2 under Average-Wet or Wet-Wet hydrologic sequences, as compared to No-Action Alternative wet year conditions. This would be a short-term impact because, in the long run, hydrology would converge to average levels and long-term land fallowing may be considerably lesser in extent. The only long-term impact would be the impact resulting from comparing the total acres that could be taken out of production from implementation of Alternative 2 under the Average-Average hydrologic sequences, as compared to No-Action Alternative average year conditions. As described in Table 4.2-6, a total of 600 acres could be taken out of production as a result of implementing Alternative 2 under Average-Average hydrologic sequences, as compared to No-Action Alternative average year conditions.

Fugitive dust could be generated from these 600 acres until native plants and grasses provide natural cover for land taken out of production. As with all impacts within the study area, the concentration of impacts to a smaller geographic area within the study area increases the relative impact, while a more uniform dispersion of impacts across the study area decreases the relative impact. It is unlikely that the amount of fugitive dust generated would constitute an adverse impact of any measurable level when considered in the context of an air basin-wide impact. To the extent that land taken out of production is concentrated in a smaller geographic area, impacts could be larger to the area directly adjacent to barren lands. In addition, fugitive dust emissions from irrigated lands are not substantially different from dry-farmed lands or fallow lands with a non-cultivated cover crop (Montgomery Watson, 1995).

CUMULATIVE IMPACTS

Cumulative impacts on a CVP-wide basis are addressed in the CVPIA PEIS. Beyond those cumulative impacts, there are no additional impacts attributable to Alternative 1 or 2 that would contribute to cumulative air quality impacts.

SECTION 4.6: SOILS AND GEOLOGY

This section discusses the potential effects that the alternatives considered Chapter 2 would have on the soils and geology within the Delta-Mendota Canal Unit. Information in this section was summarized from the Draft PEIS, Soils and Geology, Technical Appendix, Volume 2 (Reclamation, 1997b).

AFFECTED ENVIRONMENT

This section describes the existing soils and geology conditions found within the project area.

SOILS

The soils of the San Joaquin Valley are divided into four physiographic groups: valley land soils, valley basin soils, terrace soils, and upland soils. Valley land and valley basin land soils occupy most of the San Joaquin Valley floor. In the vicinity of the Delta-Mendota Canal, valley land soils consist of deep alluvial and aeolian soils that make up some of the best agricultural land in California. Valley basin lands consist of organic soils of the delta, poorly drained soils, and saline and alkali soils in the valley trough and on the basin rims.

Drainage and soil salinity problems exist in the San Joaquin Valley. Drainage problems are a result of irrigated agriculture in an area with shallow groundwater tables and little or no drainage outlet. In a large part of the valley, on the west side, shallow groundwater tables, salts imported by water deliveries, and accumulation of natural salts in soil and groundwater from irrigation threaten sustained agriculture.

Backlund and Hoppes (1984) estimated that about 2.4 million of the 7.5 million acres of irrigated cropland in the Central Valley have been affected by salt. These saline soils generally exist in the valley trough and along the eastern and western edges on both sides of the San Joaquin Valley. By the year 2000, it was projected that up to 918,000 acres of farmland in the San Joaquin Valley would be affected by a high water table existing less than five feet from the ground surface (San Joaquin Valley Drainage Program, 1990). In addition to drainage, problems have occurred with the accumulation of toxic metals (arsenic, boron, molybdenum, and selenium) that have leached from natural deposits through the application of irrigation water.

Soil selenium is primarily a concern on the west side of the San Joaquin Valley. When the soils in this area are irrigated, selenium, other salts, and trace elements dissolve and leach into the groundwater (Gilliom et al., 1989). Over the past 30 to 40 years of irrigation, most soluble selenium has been leached from the soils into the shallow groundwater. It is drained from those soils when growers try to protect crop roots from salts and the high water table.

In areas with high selenium concentrations, selenium leached from the soils enters irrigation return flows and subsurface drainage flows. Irrigation of these soils further mobilizes selenium, facilitating its movement into shallow groundwater that is retained in poorly drained soils or mechanically drained soils. In the absence of adequate drainage facilities, leaching cannot fully remove the salts from these soils because water cannot percolate beyond one or more confining clay layers under the shallow groundwater aquifer.

GEOLOGY

The San Joaquin Valley is part of a large, northwest-to-southeast-trending asymmetric trough of the Central Valley, which has been filled with up to six vertical miles of sediment. This sediment includes both marine and continental deposits ranging in age from Jurassic to Holocene. The San Joaquin Valley lies between the Coast Ranges on the west, the Sierra Nevada on the east, and extends northwestward from the San Emigdo and Tehachapi Mountains to the Sacramento-San Joaquin Delta near the city of Stockton. The San Joaquin Valley is 250 miles long and 50 to 60 miles wide. The relatively flat alluvial floor is interrupted occasionally by low hills.

The San Joaquin Valley floor is divided into several geomorphic land types including dissected uplands, low alluvial fans and plains, river floodplains and channels, and overflow lands and lake bottoms. The alluvial plains cover most of the valley floor and comprise some of the most intensely developed agricultural lands in the San Joaquin Valley. In general, alluvial sediments of the western and southern parts of the San Joaquin Valley tend to have lower permeability than eastside deposits.

Near the valley trough, fluvial deposits of the east and west sides grade into fine-grained deposits. The San Joaquin Valley has several thick lakebed deposits. The deposit that most notably affects groundwater and confinement is the Corcoran Clay Member, deposited about 600,000 years ago. This clay bed, which is found in the western and southern portions of the valley, separates the upper semi-confined to unconfined aquifer from the lower confined aquifer (Page, 1986). The clay bed covers approximately 5,000 square miles and is up to 160 feet thick beneath the present bed of Tulare Lake.

Subsidence occurs in the western San Joaquin Valley as a result of reduced groundwater elevations and the related compaction of the soil interstitial spaces that had previously been filled with groundwater. Land subsidence has caused substantial reductions in ground elevations. Figure II-6 in the Draft PEIS, Groundwater, Technical Appendix, Volume 2, shows the areal extent of land subsidence in the San Joaquin Valley (Reclamation, 1997b).

ENVIRONMENTAL CONSEQUENCES

Implementation of the project alternatives would result in adverse geologic impacts if it increased the likelihood of or resulted in exposure to earthquake damage, slope failure, foundation instability, land subsidence, or other severe geologic hazards. It would be considered an adverse impact if it caused severe erosion or sedimentation or resulted in the loss of the use of soil for agriculture or habitat, loss of aesthetic value associated with a unique landform, or loss of mineral resources.

NO-ACTION ALTERNATIVE

As discussed in the PEIS, the Preferred Alternative would, on average, reduce average annual south-of-the-Delta CVP agricultural contractor deliveries approximately 15 percent over the long term as a result of the reallocation of CVP water supplies. Accordingly, groundwater levels would decline 1 to 3 percent because of the allocation of CVP water to Level 2 refuge water supplies and improved fish and wildlife habitat. As a result of increased groundwater pumping, land subsidence could increase over its present rate.

Groundwater pumping and land subsidence will continue in the project area as they have historically. However, to the extent that reduced CVP surface water is delivered, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping would increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, the groundwater levels could decline with no or little recharge and land subsidence could increase over present rates. Soils may increase in salinity because salts may concentrate from an insufficient surface water supply for adequate leaching or because of poor quality, pumped groundwater.

ALTERNATIVE 1

Alternative 1 could have impacts similar to those discussed above for the No-Action Alternative. Groundwater pumping and land subsidence will continue in the project area as they have historically. However, to the extent that reduced CVP surface water is delivered, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping would increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, the groundwater levels could decline with no or little recharge and land subsidence could increase over present rates. Soils may increase in salinity as salts concentrate as a result of an insufficient surface water supply for adequate leaching or poor quality, pumped groundwater.

ALTERNATIVE 2

Alternative 2 could have impacts similar to those discussed above for the No-Action Alternative. Groundwater pumping and land subsidence will continue in the project area as they have historically. However, to the extent that reduced CVP surface water is delivered, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping would increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, the groundwater levels could decline with no or little recharge and land subsidence could increase over present rates. Soils may increase in salinity as salts concentrate as a result of an insufficient surface water supply for adequate leaching or poor quality, pumped groundwater.

CUMULATIVE IMPACTS

Cumulative impacts on a CVP-wide basis are addressed in the CVPIA PEIS. Beyond those cumulative impacts, there are no additional impacts attributable to Alternative 1 or 2 that would contribute to cumulative soil and geology impacts.

SECTION 4.7: GROUNDWATER

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on the groundwater resources within the Delta-Mendota Canal Unit. Information in this section was summarized from the Draft PEIS, Groundwater, Technical Appendix, Volume 2 (Reclamation, 1997b).

AFFECTED ENVIRONMENT

The southern two-thirds of the Central Valley regional aquifer system, which covers over 13,500 square miles extending from just south of the Delta to just south of Bakersfield, is referred to as the San Joaquin Valley Basin (DWR, 1975). Much of the western portion of this area is underlain by the Corcoran Clay Member that divides the groundwater system into two major aquifers: a confined aquifer below the clay and a semi-confined aquifer above the clay (Williamson et al., 1989). Aquifer recharge to the semi-confined upper aquifer historically occurred from stream seepage, deep percolation of rainfall, and subsurface inflow along basin boundaries. With the introduction of irrigated agriculture into the region, recharge was augmented with deep percolation of applied agricultural water and seepage from the distribution systems. Recharge of the lower confined aquifer results from the subsurface inflow from the valley floor and foothill areas to the east of the eastern boundary of the Corcoran Clay Member.

Groundwater in the San Joaquin Valley has been heavily developed by pumping, largely for crop irrigation. Pumping has caused depressions to form as a result of subsidence and has altered regional groundwater flow patterns, recharge, and discharge. Annual groundwater pumping in the San Joaquin River region exceeds recent estimates of perennial yield by approximately 200,000 acre-feet. All the subbasins within the San Joaquin River region have experienced some overdraft (DWR, 1994).

Land subsidence in the San Joaquin Valley has occurred mostly in areas that are confined by the Corcoran Clay, where pressure changes caused by groundwater pumping promote greater compressive stress than in the unconfined zone (DWR, 1977). The maximum land subsidence levels recorded in the Central Valley occurred within Fresno County. Land subsidence levels of as great as 30 feet have been measured in parts of northwestern Fresno County (Ireland et al., 1982).

As a result of land subsidence, increased pumping lifts, and water quality limitations, surface water was imported to the western valley to decrease pumpage. Beginning in 1967, surface water imported via the California Aqueduct began to replace groundwater as the primary source of irrigation supply in the area south of the city of Mendota. The availability of surface water led to an increase in the total quantity of water applied, whereas the quantity of water removed from the system by wells decreased. The marked decrease in pumpage has allowed a recovery in hydraulic head. The rise in the potentiometric surface from 1967 to 1984 was nearly one-half of the drawdown that occurred from predevelopment conditions to 1967. (The potentiometric surface is defined as the level that water from the confined aquifer would rise to in a tightly cased well completed in the confined aquifer.) Agricultural development also has affected the semi-confined zone. Increased rates of recharge resulting from percolation of irrigation water, combined with the rapid post-1967 decrease in pumpage, caused a rise in the height of the water table over much of the western valley (Belitz and Heimes, 1990).

Vertical groundwater flow is substantial in the western San Joaquin Valley. The combined result of pumping from below the Corcoran Clay and percolation of irrigation water from above the water table has been the development of a large downward flow gradient in the semi-confined aquifer and a groundwater flow divide in the western part of the valley (Belitz and Moore, 1990).

GROUNDWATER QUALITY

Groundwater quality conditions in the San Joaquin River Region vary throughout the area. Total dissolved solids, boron, nitrates, arsenic, selenium, and dibromo-chloropropane are parameters of concern for agricultural and municipal uses in the San Joaquin River region. Of particular concern on the west side of the San Joaquin Valley are total dissolved solids and selenium.

Groundwater zones commonly used along a portion of the western margin of the San Joaquin Valley have high concentrations of total dissolved solids, ranging from 500 milligrams per liter (mg/L) to greater than 2,000 mg/L (Bertoldi et al., 1991). The concentrations in excess of 2,000 mg/L commonly occur above the Corcoran Clay layer. These high levels have impaired groundwater for irrigation and municipal uses in the western portion of the San Joaquin Valley.

High selenium concentrations in soils of the west side of the San Joaquin River region are of considerable concern because of their potential to leach from the soil by subsurface irrigation return flow into the groundwater and into receiving surface waters. Selenium concentrations in shallow groundwater along the west side of the region have been highest in the central and southern area south of Los Banos and Mendota with median concentrations of 10,000 to 11,000 micrograms per liter (Bertoldi et al., 1991).

AGRICULTURAL SUBSURFACE DRAINAGE

Inadequate drainage and accumulating salts have been persistent problems along the west side and in parts of the east side of the San Joaquin River region for more than a century.

The most extensive drainage problems exist on the west side of the San Joaquin River and Tulare Lake regions. The soils on the west side of the region are derived from marine sediments and are high in salts and trace elements. Irrigation of these soils has mobilized these compounds and facilitated their movement into the shallow groundwater. Much of this irrigation has been with imported water containing salts, resulting in rising groundwater and increasing soil salinity. Where agricultural drains have been installed to control rising water tables, drainage water frequently contains high concentrations of salts and trace elements (San Joaquin Valley Drainage Program, 1990).

In some portions of the San Joaquin River region, natural drainage conditions are inadequate to remove the deep percolation to the water table. This occurs because vertical conductivity is low and, therefore, limits downward drainage of infiltrated water. In addition, horizontal hydraulic conductivity is low and inhibits downslope subsurface drainage. Shallow groundwater levels often rise into the root zone, and subsurface drainage must be supplemented by constructed facilities for irrigation to be sustained (Reclamation and Service, 1999).

ENVIRONMENTAL CONSEQUENCES

For purposes of this analysis, an adverse impact on the groundwater resources would occur if a long-term contract renewal:

- Results in the depletion of existing groundwater resources,
- Substantially alters the volume of groundwater available for beneficial use, or
- Causes groundwater now available for beneficial use to be unavailable because of contamination or physical obstruction.

NO-ACTION ALTERNATIVE

As discussed in the PEIS, the Preferred Alternative would reduce average annual CVP deliveries by approximately 15 percent over the long term because CVP water supplies would be reallocated. Accordingly, groundwater levels would decline 1 to 3 percent as a result of the allocation of CVP water to Level 2 refuge water supplies and improved fish and wildlife habitat. As a result, land subsidence could increase over its present rate.

Groundwater pumping and land subsidence will continue in the project area as they have historically. However, to the extent that reduced CVP surface water is delivered, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping would increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, the groundwater levels could decline with no or little recharge and land subsidence could increase over present rates. In addition, salt loading in soils and shallow groundwater would occur.

ALTERNATIVE 1

Alternative 1 could have impacts similar to those discussed above for the No-Action Alternative. Groundwater pumping and land subsidence will continue in the project area as they have historically. However, to the extent that reduced CVP surface water is delivered, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping would increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, the groundwater levels could decline with no or little recharge and land subsidence could increase over present rates. In addition, salt loading in soils and shallow groundwater would occur. These impacts would be the same as the impacts for the No-Action Alternative.

ALTERNATIVE 2

Alternative 2 could have impacts similar to those discussed above for the No-Action Alternative. Groundwater pumping and land subsidence will continue in the project area as they have historically. However, to the extent that reduced CVP surface water is delivered, especially in one or more successive dry years, groundwater pumping may prove to be more economical than obtaining surface water at the higher tiered price or through transfers. If this becomes the case, groundwater pumping would increase over present levels, especially in service areas that will tend to rely heavily on groundwater pumping because of limited, affordable surface water options. As a result, the groundwater levels could decline with no or little recharge and land subsidence increase over present rates. In addition, salt loading in soils and shallow groundwater would occur. These impacts would be the same as the impacts for the No-Action Alternative.

CUMULATIVE IMPACTS

Cumulative impacts on a CVP-wide basis are addressed in the CVPIA PEIS. Beyond those cumulative impacts, there are no additional impacts attributable to Alternative 1 or 2 that would contribute to cumulative groundwater impacts.

SECTION 4.8: SURFACE WATER RESOURCES

This section discusses the effects that the alternatives considered in Chapter 2 may have on surface water resources for the CVP contractors in the Delta-Mendota Canal Unit.

AFFECTED ENVIRONMENT

WATER RIGHTS

The Delta-Mendota Canal Unit is composed of two different types of water rights holders: (1) Exchange Contractors, who have a previous San Joaquin River water right that is now supplied by Reclamation, and (2) water service contractors, who have acquired water through the CVP. The CVP has developed different reliability criteria for each contractor type. Typically, exchange contractors have a more reliable water supply because of their pre-CVP water right.

WATER SUPPLY

Prior to the CVP, irrigators in the Central Valley depended primarily on groundwater for agricultural irrigation. As the groundwater quantity and quality declined and land subsidence increased, it became apparent that an additional source of water was needed for agriculture to continue. The CVP was implemented in part to supply irrigators, primarily in the Central Valley, with a more consistent water supply than the existing groundwater resources.

CVP water is used for irrigation of agricultural areas, M&I uses, and more recently, to restore fisheries and aquatic habitat in the waterways that have been affected by water development. The largest use of CVP water is for agricultural irrigation. The greatest demand for irrigation water occurs in mid- to late summer, as crops mature and crop water use increases. During the winter, farmers also use water for frost control and preirrigation of fields to saturate the upper soil. This saturation process loosens the soil for plowing and provides adequate moisture for seed germination. Natural winter precipitation is usually insufficient for these preirrigation needs at the lower elevations typical of the Delta-Mendota Canal Unit.

Reclamation makes water from the CVP available to contractors for reasonable and beneficial uses, but this water is generally insufficient to meet all of the contractors' needs. In the Delta-Mendota Canal Unit service area, contractors without a sufficient CVP water supply may extract groundwater if pumping is feasible or negotiate water transfers with other contractors. Alternative supplies from groundwater pumping and/or transfers are accessed as supply sources when CVP surface water deliveries become more expensive than pumping or transfer costs. However, increased groundwater pumping can cause overdraft conditions and land subsidence. Shallow aquifers have been contaminated by years of irrigation in the valley. The application of pesticides and herbicides and the solublization of naturally occurring trace elements in the soil, including selenium, boron, and arsenic, contribute to groundwater contamination.

The CVPIA PEIS developed estimates of maximum water contract deliveries for the year 2026. These estimates were based on previous use, existing contract amount, and appropriate existing general plan environmental documentation relevant to CVP water use. The estimates for the two types of contracts, depending on the type of service, include the following:

- **Agricultural Water Service Contracts:** The maximum annual use between 1980 and 1993 or the projected use as addressed in the appropriate environmental documentation, limited by the maximum contract amount.
- **Water Rights and Exchange Contractors:** The maximum annual use between 1980 and 1993 or projected use as addressed in relevant environmental documentation, limited by the maximum contract amount.
- **M&I Water Service Contracts:** Total demand based on 2020 demands in California Department of Water Resources Bulletin 160-93 or the shortage criteria; maximum shortage of 25 percent.

WATER DELIVERY CRITERIA

The amount of CVP water available each year for contractors is based on the storage of winter precipitation and control of spring runoff in the Sacramento and San Joaquin River basins. The schedule of CVP water conveyed to and diverted from the river is determined by state water right permits, judicial decisions, and state and federal obligations to maintain water quality, enhance environmental conditions, and prevent flooding. The allocation of CVP water to the contractors is determined by water service contracts and the capacity of project facilities to store and convey water.

CONDITIONS WITH CVPIA IMPLEMENTATION

Impacts associated with CVPIA implementation for CVP water service contractors were discussed in the PEIS and summarized in Chapter 3 of this EA. With CVPIA implementation in accordance with the PEIS Preferred Alternative, in addition to conditions in the late 1990s, CVP agricultural water service contractors located south of the Delta received an average of 59 percent of existing total contract amounts, based upon a hydrologic pattern that is similar to the last 70 years of hydrology, as shown in Figure 4.8-1 and described in Technical Appendix, Volume 2, of the Draft PEIS

(Reclamation, 1997b). These conditions result in delivery of total contract amounts to agricultural water service contractors located south of the Delta approximately 15 percent of the time. Minimum deliveries of zero would occur only in critical dry years.

Under these conditions, CVP municipal water service contractors received an average of 85.5 percent of existing total contract amounts, as shown in Figure 4.8-1. These conditions resulted in delivery of total contract amounts to municipal water service contractors located south of the Delta approximately 65 percent of the time. Minimum deliveries of 50 percent would occur only in extremely critical dry years.

ENVIRONMENTAL CONSEQUENCES

NO-ACTION ALTERNATIVE

Under the PEIS No-Action Alternative, average annual deliveries under the CVP would be 5,700,000 acre-feet per year, including deliveries to refuges, water rights holders, Sacramento River Settlement Contractors, Delta-Mendota Exchange Contractors, and CVP water service contractors. Total CVP water deliveries would decrease under most alternatives, including the Preferred Alternative, by about 10 percent as a result of the allocation of CVP water to Level 2 refuge water supplies, improved fish and wildlife habitat, and reduced Trinity River exports to the Central Valley.

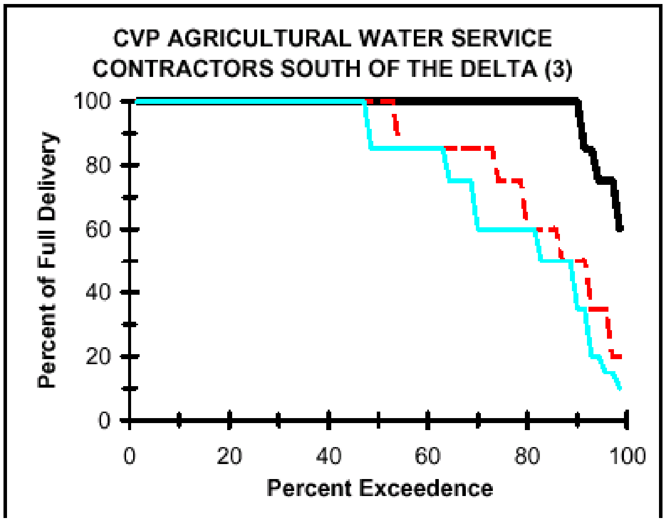
Average annual CVP water deliveries to Water Service Contractors would decrease from 2,270,000 acre-feet per year under the No-Action Alternative to 1,933,000 acre-feet per year under all of the PEIS alternatives, including the Preferred Alternative, as a result of the reallocation of CVP water supplies.

ALTERNATIVE 1

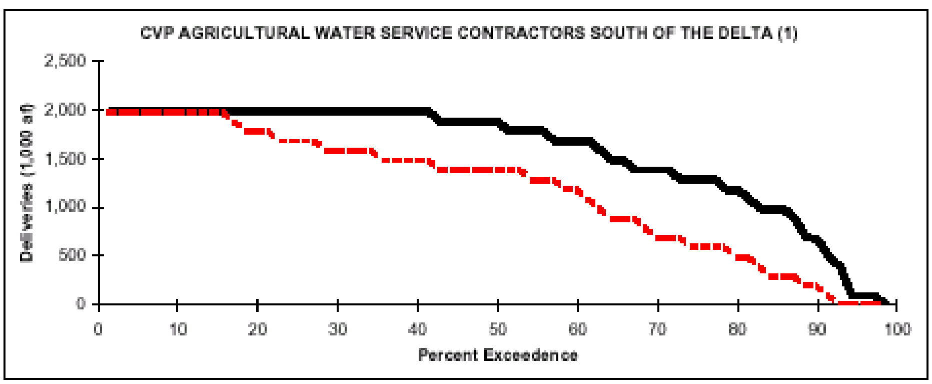
Explanatory recitals and provisions in Alternative 1 differ from the No-Action Alternative by emphasizing increased water supply reliability through the completion of yield increase studies and the development of CVP operational criteria that would minimize delivery shortages. Although these recitals and provisions call for increased supply reliability, future reliability will actually depend on several interacting factors, including water year type and the implementation of other water development projects. The action of renewing long-term water service contracts under Alternative 1 does not substantially differ from the No-Action Alternative with respect to the following:

- “Contract Total” definition.
- Water to be made available and delivered to the contractor.

Figure 4.8-1
Percent of Full Delivery; CVP Agricultural and M&I Water Service Contractors South of the Delta



Source: Figure IV-1 of the Pre-CVPIA Conditions Technical Appendix, Volume 2, of the CVPIA Draft PEIS (Reclamation, 1997b)



Source: Figure IV-80 of the CVPIA Final PEIS (Reclamation and Service, 1999)

- The time for delivery of water.

- The point of diversion and responsibility for water distribution.

- Water measurement.

- Rates and methods of payment for water.

Because there are no substantial differences between Alternative 1 and the No-Action Alternative, there would be no surface water supply impacts from implementation of Alternative 1.

ALTERNATIVE 2

The action of renewing long-term water service contracts under Alternative 2 does not substantially differ from the No-Action Alternative with respect to the following:

- "Contract Total" definition.

- Water to be made available and delivered to the contractor.

- The time for delivery of water.

- The point of diversion and responsibility for water distribution.

- Water measurement.

- Rates and methods of payment for water.

Because there are no substantial differences between Alternative 2 and the No-Action Alternative, there would be no surface water supply impacts from implementation of Alternative 2.

CUMULATIVE EFFECTS

Cumulative effects on a CVP-wide basis are addressed in the CVPIA PEIS. Beyond those cumulative impacts, there are no additional impacts attributable to Alternative 1 or 2 that would contribute to cumulative water supply impacts.

SECTION 4.9: SURFACE WATER QUALITY

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on surface water quality in the Delta-Mendota Canal Unit.

AFFECTED ENVIRONMENT

Surface water quality in the San Joaquin River Basin is affected by several factors, including natural runoff, agricultural return flows, biostimulation, construction, logging, grazing, operations of flow-regulating facilities, urbanization, and recreation. In addition, irrigated crops grown in the western portion of the San Joaquin Valley have accelerated the leaching of minerals from soils, altering water quality conditions in the San Joaquin River system.

In the western part of the San Joaquin Valley, soils are derived mainly from the marine sediments that make up the Coast Range and are high in salts and trace elements such as selenium, molybdenum, arsenic, and boron. As a result of extensive land development in the San Joaquin Valley, erosion and drainage patterns have been altered, thereby accelerating the rate at which these trace elements have been dissolved from the soil to accumulate in groundwater, streams, and the San Joaquin River.

Water quality in the San Joaquin River varies considerably along the river's length. Above Millerton Lake and downstream toward the Mendota Pool, water quality is generally excellent. The reach from Gravelly Ford to the Mendota Pool (about 17 miles) is frequently dry except during flood control releases, because all water released from Millerton Lake is diverted upstream to satisfy water rights agreements or percolated to groundwater. During the irrigation season, most of the water released from the Mendota Pool to the San Joaquin River is imported from the Delta via the Delta-Mendota Canal and generally has higher concentration of total dissolved solids than water in the upper reaches of the San Joaquin River. Most of the water released from the Mendota Pool to the San Joaquin River is diverted at or above Sack Dam for agricultural uses. Between Sack Dam and the confluence with Salt Slough, the San Joaquin River is often dry. From Salt Slough to Fremont Ford, most of the flow in the river is derived from irrigation returns carried by Salt and Mud Sloughs. This reach typically has the poorest water quality of any reach of the river.

As the San Joaquin River progresses downstream from Fremont Ford, water quality generally improves at successive confluences, specifically at those with the Merced, Tuolumne, and Stanislaus Rivers. In the relatively long reach between the Merced and Tuolumne Rivers, however, mineral concentrations tend to increase as a result of agricultural drainage water, other wastewaters, and effluent groundwater (DWR, 1965).

Total dissolved solids in the San Joaquin River near Vernalis have historically ranged from 52 mg/L (at high stages) to 1,220 mg/L during the 1951-1962 period (DWR, 1965). During the mid- to late 1960s, San Joaquin River water quality continued to decline. In 1972, the State Board included a provision in Decision 1422 that Reclamation maintain average monthly total dissolved solid concentrations in the San Joaquin River at Vernalis of 500 mg/L as a condition of the operating permit for New Melones Reservoir on the Stanislaus River.

ENVIRONMENTAL CONSEQUENCES

NO-ACTION ALTERNATIVE

The No-Action Alternative would not result in any alteration to surface water quality. Continued operation of the system of pumps, canals, laterals, and related water conveyance and distribution facilities would not lead to degradation in water quality. Water quality impacts would be the same as those identified in the CVPIA PEIS. Current trends affecting the surface water quality would continue. No additional impacts would occur from the implementation of the No-Action Alternative beyond those discussed in the CVPIA PEIS.

In drier years, water quality of CVP water decreases as well as water supply reliability. First, the salinity and the concentration of organic materials from upstream soils and return flows increases in the Delta in drier years because the flow volumes from the Sacramento and San Joaquin Rivers decrease and salt water intrudes further upstream in the Delta. The presence of high salinity and organic material increases the cost to provide drinking water in accordance with California Safe Drinking Water Act. In addition, as CVP and SWP pumping is reduced to protect Delta water quality and habitat and as users south of the Delta withdraw water from San Luis Reservoir, the water depth in San Luis Reservoir becomes shallower. The shallow water becomes warm and light penetration becomes greater. These conditions lead to growth of algae and other microorganisms. The biological material causes taste and odor problems and further increases the cost to provide safe drinking water. The biological material also clogs irrigation equipment.

ALTERNATIVE 1

Alternative 1 would not result in any alteration to surface water quality because there would be essentially no drainage when compared to the No-Action Alternative. Continued operation of the system of pumps, canals, laterals, and related water conveyance and distribution facilities would not lead to degradation in water quality. Current trends affecting the surface water quality would continue.

ALTERNATIVE 2

Alternative 2 would not result in any alteration to surface water quality as along as water delivery remains the same and, thus, drainage also remains the same. Continued operation of the system of pumps, canals, laterals, and related water conveyance and distribution facilities would not lead to degradation in surface water quality and current trends affecting the surface water quality would continue. However, to the extent that reduced CVP surface water is delivered, especially in one or more successive dry years, less drainage to surface waters would occur. As a result, surface water quality in the Delta-Mendota Canal Unit may improve because of reduced mobilization of salts through reductions in drain waters.

CUMULATIVE IMPACTS

Cumulative impacts on a CVP-wide basis are addressed in the CVPIA PEIS. Beyond those cumulative impacts, there are no additional impacts attributable to Alternative 1 or 2 that would contribute to cumulative surface water quality impacts.

SECTION 4.10: BIOLOGICAL RESOURCES

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on biological resources in the Delta-Mendota Canal Unit. The project area is located in portions of San Joaquin, Stanislaus, Merced, and Fresno Counties. In the project area, a variety of vegetation types and wildlife resources could potentially be affected by the long-term contract renewals. In addition, special-status species that may occur in the project area are also identified.

Baseline information on biological resources, including special-status species and their habitats, in the Delta-Mendota Canal Unit project area was compiled primarily from existing literature and information gathered from water district general managers and staff. Data sources included the CVPIA Draft PEIS (Reclamation, 1997a), Draft EA for Eastside/Westside Water Transfer/Exchange (Tetra Tech, 2000), Draft Biological Opinion on Operation of the CVP and Implementation of the CVPIA (Reclamation and Service, 2000), A Guide to Wildlife Habitats of California (Mayer and Laudenslayer, 1988), and vegetation categories derived from CALVEG data (Matyas and Parker, 1980). Additional data sources used for identifying the presence or absence of special-status species included the California Fish and Game Natural Diversity Database and California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California.

AFFECTED ENVIRONMENT

Historically, the region surrounding the Delta-Mendota Canal Unit contained a diverse and productive patchwork of aquatic, wetland, riparian forest, and surrounding terrestrial habitats that supported abundant populations of resident and migratory species of wildlife (Tetra Tech, 2000). Huge herds of pronghorn, tule elk, and mule deer grazed the prairies, and large flocks of waterfowl occurred in the extensive wetlands. The major natural plant communities included grasslands, vernal pools, marshes, and riparian forests.

Today, land uses in the region, including agricultural, residential, and M&I uses, have converted land from native habitats to cultivated fields, grazing, homes, water impoundments, flood control structures, and other developments. Most of the species that occurred historically in the region remain in these same areas, although at lower than historical numbers. Because of the reduction in the acres of habitat available to these species, remnants of habitats such as wetlands and riparian forests are increasingly valuable.

Historical fishery resources within the project area were different from the fishery resources present today (Reclamation, 1997a). Many native species have declined in abundance and distribution, and several introduced species have become well established. The major factors producing changes in aquatic habitat within the project area are habitat modification, species introduction, and overfishing of fishery resources that originate in the project area. These factors and anthropogenic activities within the project area have adversely affected the fisheries resources in the area.

AQUATIC HABITAT AND FISH

Streams that make up the aquatic habitats within the project area are typically small intermittent streams that drain the Coast Ranges but rarely reach the San Joaquin River. On the east side, three major tributaries of the San Joaquin River drain the western Sierra Nevada and provide flow to the San Joaquin River. These tributaries, the Stanislaus, Tuolumne, and Merced Rivers, are located east of the project area and provide habitat, spawning, and rearing for salmonids. Impoundments on each of these rivers provide flood control, irrigation, and power generation. The lower San Joaquin River flows east of the project area.

Historically, the upper reaches of the San Joaquin River and its tributaries have provided habitat for chinook salmon and steelhead trout. Spring-run chinook historically used the upper reaches of the San Joaquin River, but was extirpated when Friant Dam was completed in 1949. Spring-run chinook was probably eliminated by 1930 from the Stanislaus, Tuolumne, and Merced Rivers as a result of the construction of water storage facilities. Both fall-run chinook salmon and steelhead trout continue to use these tributaries; their returns have been low for a number of years. The Merced River Fish Hatchery, operated by California Department of Fish and Game, produces fall-run chinook salmon. This facility is the only salmon production facility located within the San Joaquin River basin.

Little information exists about fishery resources in water bodies located within the project area. The intermittent streams located within the project area are not known to support anadromous fish and are unlikely to support populations of resident fish because of the hydrologic conditions. The numerous water conveyance facilities, water supply, and drainage canals could support warm-water fish, such as bass, crappie, sunfish, bullhead, and Sacramento sucker, and various minnow species such as Sacramento pikeminnow (formerly squawfish).

The two fish species of greatest concern in the San Joaquin basin are briefly described below. Common and scientific names of fish species cited in this document are provided in Appendix B.

Fall-Run Chinook Salmon

Populations of fall-run chinook salmon have persisted within the San Joaquin River basin, although greatly reduced since the 1940s. The populations have varied in size and are limited to habitat located downstream of the major dams on the Stanislaus, Tuolumne, and Merced Rivers. Barriers to adult migration include low stream flow and low dissolved oxygen levels in the lower San Joaquin River and south Sacramento-San Joaquin River Delta (Delta) channels. These water quality conditions have contributed to low returns of adults to upstream spawning habitats. The current population trends indicate considerable annual variability in escapement levels of fall-run chinook salmon in the Stanislaus, Tuolumne, and Merced Rivers. Typically, escapements have been proportional to the spring-runoff years, with high returns observed following high spring flows and small returns following drier runoff years.

Adult fall-run chinook salmon migrate through the Delta and into Central Valley rivers from July through December and spawn from October through December. Peak spawning usually takes place in October and November with egg incubation beginning in October and extending to mid-May during some years. Chinook salmon fry (juveniles less than 2 inches long) generally emerge from December through March, with peak emergence by the end of January. Generally, fry emigrate from December through March and smolt (young salmon about two years old and at the developmental stage when they assume an adult's silvery color) emigrate from April through June. A small proportion of the population emigrates as yearlings from October through December.

Two major movements of juvenile fall-run chinook salmon into the Delta estuary have been identified. The first group of fry begin entering the estuary in January, with peak abundance occurring in February and March; fry abundance in the Delta increases following high winter flows. The second group and later emigration of smolts occurs from April through June. This group of fry continues rearing in the upper estuary and emigrates as smolts during the normal smolt emigration period. Smolts reared in upstream habitat migrate quickly through the Delta and Suisun and San Pablo Bays.

Steelhead Trout

Similar to chinook salmon, the physical habitat for steelhead trout spawning has been greatly reduced within the project area. Steelhead trout spawn in the upper reaches of some of the San Joaquin River tributaries and rear for a year or more before emigrating to the Delta estuary. Water quality conditions including elevated water temperatures and agricultural return flows containing pesticides and salts adversely affect survival of juvenile steelhead trout.

Factors Affecting Abundance

The total basin outflow has been reduced as a result of the construction and operation of impoundment facilities located on the San Joaquin River and its tributaries. In addition, water quality has been substantially altered by pesticides and salts from agricultural drainage. Reduced flows in the San Joaquin River and high exports from Delta water diversions have reduced the survival of juvenile salmonids in the San Joaquin River. These conditions have combined to adversely affect anadromous fisheries, particularly in the south Delta region. Salmon straying into west-side canals, small and medium-sized diversions, elevated water temperatures, channel dredging, waste discharges, and low dissolved oxygen concentrations also adversely affect anadromous fisheries resources (Reynolds et al., 1993). Factors such as water diversions, inadequate or nonexistent screening facilities, and barriers to fish migration adversely affect salmon and steelhead production.

Upstream Migration. For many years, attraction flows from the Merced River have proved inadequate during October, resulting in straying of adult salmonids into agricultural drainage ditches. Barriers (electrical and physical) were installed across the San Joaquin River upstream of the Merced River confluence in 1992 to prevent salmon migration into these sloughs and help guide the salmon into the Merced River.

Low dissolved oxygen concentrations (less than 5 mg/L) and high water temperatures (greater than 66ºF) in the San Joaquin River near Stockton delayed or blocked the migration of adult salmonids during the 1960s (Hallock et al., 1970). Since 1964, fall migration problems have been reduced by improved wastewater treatment and installation of a physical barrier at the head of Old River in dry years to direct most of the San Joaquin flows down the main channel past the city of Stockton. Despite these efforts, low dissolved oxygen concentrations continue to occur during drought conditions.

Spawning. Chinook salmon and steelhead trout use the San Joaquin River and its tributaries as migration corridors to stream reaches that provide spawning habitat in the Stanislaus, Tuolumne, and Merced Rivers. Water temperatures below major reservoirs in the San Joaquin River tributaries frequently do not permit successful spawning of fall-run chinook salmon until November. Although spawning habitat does not appear to be limiting recovery of fall-run chinook salmon stocks in the San Joaquin River Basin, spawning gravel restoration might be needed in the future to offset gravel depletions below dams and to provide sufficient spawning habitat to accommodate future adult populations.

Juvenile Rearing. Streamflow has been identified as the primary factor affecting the abundance of chinook salmon stocks in the San Joaquin River Basin. Streamflow reductions after April and May in the Merced and Tuolumne Rivers result in poor survival conditions for chinook salmon juveniles that remain in these tributaries beyond these months. High mortality generally results from reduced living space, high water temperatures, and increased predation. Current interim instream flow requirements in the Stanislaus River provide adequate flow conditions through the chinook salmon rearing period.

Generally, water temperatures below major dams on the San Joaquin River tributaries become unsuitable for chinook salmon rearing in May or June, causing high mortality of juvenile chinook salmon that have not emigrated. However, in the Stanislaus River, releases of cold hypolimnetic water from New Melones Reservoir have improved water temperatures during the late spring rearing period relative to preimpoundment conditions (Reclamation, 1986).

Selenium in agricultural drainage water poses a potential risk to juvenile chinook salmon in the San Joaquin River. Selenium is directly toxic to fish at elevated levels in the water column and through bioaccumulation in body tissues. Growth and survival of juvenile chinook salmon are adversely affected by exposure to dissolved and dietary selenium. However, harmful levels have not been detected in the major rearing areas of the San Joaquin River and its tributaries (CDFG, 1987).

Juvenile Emigration. Spring flows in the San Joaquin River and major tributaries during the chinook salmon emigration period appear to have a major influence on the number of adults returning to the San Joaquin River Basin. Positive correlations exist between spring flows in the San Joaquin River and total fall-run chinook salmon spawning escapement 2.5 years later. Smolts emigrating in the San Joaquin River and through the southern Delta frequently encounter low flows, high temperatures, and high diversion rates. Proposed spring outflow recommendations for the Merced, Tuolumne, and Stanislaus Rivers are designed to improve survival of juvenile salmon emigrating down the tributaries the mainstem of the San Joaquin River and through the Delta.

Declining streamflow during the spring emigration period of fall-run chinook salmon coincides with rising air temperatures and increased agricultural return flows to the San Joaquin River, often resulting in rising water temperatures along much of the emigration route in the lower San Joaquin River. During May, water in the San Joaquin River near Vernalis often reaches temperatures greater than 67.6ºF at flows of 5,000 cubic feet per second or less. Under these conditions, up to half the production of San Joaquin River chinook salmon can be subjected to harmful water temperatures (CDFG, 1987).

Delta Flows and Exports. Data indicate that pumping by the CVP and SWP export facilities in the south Delta has a major impact on the survival of emigrating juvenile chinook salmon. High juvenile mortality in the lower San Joaquin River and Delta is associated with low spring outflows and corresponding increases in the proportion of San Joaquin River flow diverted by CVP and SWP export facilities. At low San Joaquin River flow, high diversion rates increase the proportion of San Joaquin River flow drawn toward the SWP and CVP facilities via Old River. Juvenile salmon diverted with the flow experience reduced survival associated with increased migration time, high water temperatures, predation, entrainment in unscreened agricultural diversions, and Delta export pumping. Maximum survival benefits could result from reduced exports, increased San Joaquin flows, and a barrier at the head of Old River during the spring emigration period (Service, 1993).

VEGETATION TYPES, HABITATS, AND WILDLIFE

The natural terrestrial community types associated with the project area are grassland, valley foothill riparian, alkali desert scrub, and fresh emergent wetlands. Agricultural communities within the project area are very diversified, and almost half of the irrigated acreage in the San Joaquin region is planted with grains, hay, and pasture (Reclamation, 1997a). Orchards are planted on about 30 percent of the irrigated acres; cotton and vegetables are each planted on about 10 percent.

The following discussion describes vegetation types, plants, and animals located in and adjacent to the project area. Common and scientific names of plants and animals are provided in Appendix B.

Grassland

Grassland vegetation is characterized by a predominance of annual or perennial grasses in an area with few or no trees and shrubs. Annual grasses found in grassland vegetation include wild oats, soft chess, ripgut grass, medusa head, wild barley, red brome, and slender fescue. Perennial grasses found in grassland vegetation are purple needlegrass, Idaho fescue, and California oatgrass. Forbs commonly encountered in grassland vegetation include long-beaked filaree, redstem filaree, dove weed, clovers, Mariposa lilies, popcornflower, and California poppy. Vernal pools found in small depressions with an underlying impermeable layer are isolated wetlands within grassland vegetation.

Grassland habitats are important foraging areas for black-shouldered kite, red-tailed hawk, Swainson’s hawk, northern harrier, American kestrel, yellow-billed magpie, loggerhead shrike, savannah sparrow, American pipit, mourning dove, Brewer’s blackbird, red-winged blackbird, and a variety of swallows. Birds such as killdeer, ring-necked pheasant, western kingbird, western meadowlark, and horned lark nest in grassland habitats. Grasslands also provide important foraging habitat for the coyote and badger because this habitat supports large populations of small prey species, such as the deer mouse, California vole, pocket gopher, and California ground squirrel. Common reptiles and amphibians of grassland habitats include western fence lizard, common kingsnake, western rattlesnake, gopher snake, common garter snake, western toad, and western spadefoot toad.

Valley Foothill Riparian

Valley foothill riparian vegetation occurs in valleys and bottomlands bordered by gently sloping alluvial fans and dissected terraces and coastal plains. Valley foothill riparian vegetation generally consists of woodlands or forests of broad-leaved deciduous hardwood trees as the overstory, with a variety of shrubs and vines composing the midstory, and a few grass and forb species and vines composing the understory. The floodplains of valley foothill riparian communities are usually well-developed. Fluvial processes such as flooding, with its resulting sediment deposition and bank erosion, create three characteristic riparian landforms: gravel point bars, low terraces, and high terraces. Each landform has a different hydrology because of its physical relationship to the aquifer and flooding.

Gravel Bar. Gravel bar habitats are subject to seasonal flooding and are sensitive to changes in flow volumes, timing, and rates of change in flow volumes. High spring flows and low summer flows often keep gravel bar plant communities from developing.

Willow scrub and willow-cottonwood forests develop on gravel bars. Willow scrub vegetation is the “pioneering” vegetation on point bars, creek edges, canal slough banks, and low river terraces. Dense thickets of one or more willow species (e.g., sandbar, red, arroyo, and black willow) develop on point bars and creek edges. Dense willow thickets, which contain small amounts of cottonwood, white alder, and mule fat with occasional interior live oak and elderberry along the upper edges, develop on canal slough banks and low river terraces. Willow-cottonwood forests form dense sapling stands or forests to 60 feet in height. Black willow, arroyo willow, and cottonwood dominate the canopy. Older stands typically have a midstory of willows and box elder or thickets of California wild grape, blackberries, and poison oak. Herbaceous vegetation can be sparse or dense and includes species such as cocklebur, mugwort, umbrella-sedge, and horseweeds.

Because willow scrub habitat frequently grows in dense clumps, it offers cover to a variety of wildlife species. Beaver preferentially feed on young willow shoots, and many small birds and mammals feed on willow seeds. Willows support an abundance of insect prey that feed on fresh foliage and stems during the growing season. These insects, in turn, support a high density and diversity of migratory and resident insectivorous birds, including the western flycatcher, yellow warbler, MacGillivray's warbler, Wilson's warbler, and song sparrow. Some species have declined or been eliminated from the valley floor as nesting species, among them the willow flycatcher, yellow warbler, and yellow-breasted chat.

Species that forage on seeds and foliage in scrub and herb habitats along creeks and rivers include the California ground squirrel, Botta's pocket gopher, California vole, California quail, mourning dove, European starling, American goldfinch, and Brewer's blackbird. Aquatic areas within the river channels also provide foraging habitat for carnivores and omnivores such as river otter, common merganser, common goldeneye, and a variety of gulls. Ground insectivores of the gravel bar riparian community include the western fence lizard, killdeer, spotted sandpiper, western kingbird, and broad-footed mole. Vertebrate predators include the gopher snake, red-tailed hawk, and striped skunk. Unvegetated vertical banks along the rivers provide nesting substrates for a variety of specially adapted species. The bank swallow, belted kingfisher, and northern rough-winged swallow depend on vertical banks for nesting, and a few other species such as common barn owls and burrowing owls will also nest in these habitats.

Low Terrace. Low terrace habitats develop as sediment accumulates on gravel bars. Communities of this habitat are sensitive to floodplain water-level fluctuations and changes in flood intensity or duration. These communities are typically inundated only during flood flows. Three plant communities develop on low terrace sites: mature cottonwood riparian forest, mixed riparian herb/scrub, and alder-willow forests. Mature cottonwood forests develop from young-growth willow-cottonwood forests. Forest heights can exceed 100 feet with a canopy of cottonwood or cottonwood-black willow. California wild grape or mistletoe may also occur in the canopy. A midstory of black willow, box elder, Oregon ash, and Northern California black walnut is typical of stands not dominated by California wild grape, a dense herb-vine that often forms an impenetrable understory. Large trees in these forests provide habitat elements required by several wildlife species. Cottonwood trees provide adequate nesting support for larger birds such as hawks, owls, American crow, great egret, and great blue heron. Cavity-nesting species such as woodpeckers, wood ducks, bats, western gray squirrel, raccoon, and ringtail require mature stands.

The mixed riparian herb/scrub community is located on riverbanks, berms, and terraces; occupying sites where disturbance from levee maintenance and farming practices prevent mature riparian forests from developing. Herbaceous dominants include weedy annual grasses, sedges, rushes, and numerous forbs such as horsetails, mustards, and thistles. The scrub layer consists of shrub, vine, and tree saplings of willow, mule fat, blackberries, California wild grape, California wild rose, box elder, Fremont cottonwood, and Oregon ash. The mixed riparian herb/scrub community provides a variety of resources used by wildlife. Common wildlife species in mixed riparian herb/scrub communities include those dependent on nectar, fruit, and seeds, such as Anna's hummingbird, scrub jay, black-headed grosbeak, lazuli bunting, rufous-sided towhee, house finch, Virginia opossum, raccoon, striped skunk, and gray fox. The mixed scrub habitat also supports many of the insectivorous bird species that occur in willow scrub habitat.

Alder-willow forests are primarily associated with canals, sloughs, streams, and channelized rivers where steep gravel, rock, or riprap banks extend to a shoreline defined by sustained summer water levels. Alder-willow forests typically form narrow bands along the shoreline that often overhang the water. White alder, arroyo willow, black willow, and red willow, with some Fremont cottonwood and Oregon ash dominate the 10- to 40-foot-tall canopy. The typically narrow, linear nature of the alder-willow forest favors forms of wildlife that forage in adjacent herb-dominated communities or agricultural habitats, including black-shouldered kite, American kestrel, and western kingbird. It also provides perches and cover for species that forage in or over water, including double-crested cormorant, green-backed heron, belted kingfisher, violet-green swallow, tree swallow, black phoebe, beaver, river otter, and various bat species.

High Terrace. High terrace habitats are inundated only during peak storm runoff events and are not subject to severe physical battering or erosion (aside from bank erosion) or long-term flooding. Mixed riparian forest and valley oak riparian forest typify high terrace riparian communities.

Lush, multilayered 150-foot-tall gallery forests characterize this community. The canopy includes Fremont cottonwood, western sycamore, Oregon ash, Northern California black walnut, and valley oak. Midstories include black willow, box elder, and young trees of canopy species. Shrub understories often include impenetrable vine thickets of California wild grape, blackberries, poison oak, California wild rose, and California pipestem clematis. These vines drape over the midstory and canopy layers, imparting a junglelike appearance. Herb layers are typically dense.

Mixed riparian forests support the most dense and diverse wildlife communities in the Central Valley. The diversity of plant species and growth forms provides a variety of foods and microhabitat conditions for wildlife. Wildlife present include most of the species that occur in cottonwood forest and riparian scrub habitats. Oaks, walnuts, and other mast-producing trees support certain species that do not occur in the other habitats, such as acorn woodpeckers, plain titmouse, and white-breasted nuthatch.

Valley oak riparian forests develop on the highest terraces where flooding is least frequent and short in duration. They are the rarest community in the Central Valley relative to their original extent. Valley oak riparian forest develops from mixed riparian forests where dense California wild grapevines have not prevented establishment of oak seedlings. The sparse to dense canopy consists of valley oak occasionally interspersed with Northern California black walnut. The sparse midstory consists of tree saplings, California wild grape, poison oak, blue elderberry, and blackberries. A lush grass or sedge-dominated herbaceous layer is typical.

Valley oak riparian forests provide nesting sites for red-tailed hawk, Swainson's hawk, and herons and egrets that require sturdy nesting sites and an open canopy for easy nest access. Valley oak stands also provide the best habitat for the acorn woodpecker, plain titmouse, and western gray squirrel. The open oak canopy provides perch sites for aerial foraging species such as the Lewis' woodpecker, ash-throated flycatcher, and western wood-peewee. It also offers perch sites for species that search for prey on the ground, such as the western bluebird and northern flicker. The furrowed bark on older oaks provides foraging habitat for species such as the Nuttall's woodpecker and white-breasted nuthatch that probe and peck for insects. Older trees provide an abundance of holes for cavity-dependent species.

Alkali Desert Scrub

Alkali desert scrub is generally characterized by a dominance of chenopods (members of the *Chenopodiaceae* family) or other halophytes, and exists in two distinct phases: xerophytic (drought-tolerant plants) and halophytic (salt-tolerant plants). In the project area, alkali desert scrub plant communities occur at low elevations in the western San Joaquin Valley.

The xerophytic phase is represented by open stands of widely spaced, low (0.8 foot) to moderately high (7 feet) grayish, spiny, and small-leaved shrubs and subshrubs. Allscale, fourwing saltbush, Parry saltbush, shadscale, and big saltbush are common shrubby saltbush species of this phase. Other important shrubs include bud sagebrush, Nevada tea, Fremont dalea, and creosote bush. Cheesebush, alkali goldenbush, and honeysweet tidestromia are common subshrubs in this phase. Forbs and grasses that characterize this phase include Torrey blazing star, kidney-leaved buckwheat, and apricot globemallow.

Closely spaced, not very woody, and more or less succulent plants that tolerate periodic flooding characterize the halophytic phase. This phase generally does not exceed a height of 3.3 feet. Common shrub and subshrubs found in this phase include arrow weed, greasewood, alkali goldenbush, kochia, iodine bush, and alkali rubber rabbitbrush. Common forbs and grasses are alkali heath, alkali weed, alkali heliotrope, arrow-grass, yerba mansa, and alkali sacaton.

Common birds that forage or nest in alkali desert scrub include roadrunner, mourning dove, blue-gray gnatcatcher, common raven, sage sparrow, white-crowned sparrow, house finch, American goldfinch, and lesser goldfinch. Common mammals include pocket gopher, California ground squirrel, desert cottontail, deer mouse, California vole, Heermann's kangaroo rat, black-tailed hare, striped skunk, badger, and coyote. Reptiles, such as side-blotched lizard, western whiptail, western fence lizard, gopher snake, and western rattlesnake, are commonly observed in alkali desert scrub habitat.

Fresh Emergent Wetlands

Freshwater emergent wetlands are characterized by the presence of erect, rooted, herbaceous plants that require, or are tolerant of, saturated or flooded soils. The community is intolerant of quickly flowing water, water depths exceeding five feet, rapid or wide fluctuations in water level, and saltwater. This community is restricted to ponds, canals, sloughs, river backwaters, and similar habitats. Freshwater emergent wetlands in the Central Valley are dominated by dense growths of tules and cattails, with occasional verbena, smartweed, rose-mallow (California hibiscus), and various rush and sedge species.

Freshwater emergent wetlands of the project area provide important habitat for waterfowl and a variety of other wildlife species, including grebes, herons, egrets, bitterns, coots, shorebirds, rails, hawks, owls, muskrat, raccoon, opossum, and beaver. Many other upland species such as ring-necked pheasant, California quail, black-tailed hare, and desert cottontail take cover and forage at the margins of wetland habitats. Many reptiles and amphibians such as common garter snake, aquatic garter snake, Pacific treefrog, and bullfrog also breed and feed in freshwater wetlands.

Vernal Pools

Vernal pools are seasonal wetlands that are unique to the Mediterranean climate region of California and northwestern Baja California and are most abundant in the Central Valley. Vernal pools develop in shallow basins that form in flat to hummocky terrain. Soil durapans underlying the basins prevent water infiltration and the nearly level terrain inhibits surface water runoff. Vernal pools are important communities because of their current scarcity. Holland (1978) estimated that 5 to 30 percent of California's vernal pools are intact today; the figure for the Central Valley is about 5 percent.

Vernal pools support an ephemeral flora dominated by terrestrial annual species, with perennial and aquatic species often contributing substantial cover. Vernal pool species flower throughout the spring, resulting in conspicuous zonation patterns formed by consecutively blooming species around drying pool margins. Characteristic dominant plants include popcornflower, low barley, downingia, coyote-thistle, goldfields, meadowfoam, owl's clover, pogogyne, woolly marbles, and navarretia.

Although vernal pools are an ephemeral aquatic habitat, invertebrates and amphibians have adapted to this environment. When standing water is available, California tiger salamanders, western spadefoot toads, and Pacific treefrogs may use the pools for egg-laying and for the development of young. Aquatic invertebrates, such as fairy shrimp, tadpole shrimp, clam shrimp, cladocerans, copepods, and crawling water beetles, also inhabit vernal pools. In winter and spring, water birds such as mallards, cinnamon teal, killdeer, California gulls, green-backed herons, great blue herons, and great egrets use vernal pools for resting and foraging grounds. Western kingbirds, black phoebes, and Say's phoebes feed on flying insects above vernal pools.

Managed Wetlands. Managed wetlands are used on federal and state refuges to maximize habitat suitability for waterfowl and other wetland-dependent wildlife. Managed wetlands can be broadly categorized into permanent wetlands, semipermanent wetlands, seasonal wetlands, and moist soil plant areas. Most of the managed wetlands on nearby refuges are seasonal wetlands.

Permanent wetlands are flooded throughout the year, with periodic drainage to control emergent vegetation and increase productivity. Water is maintained at a depth from 2.5 to 4 feet. Dominant vegetation includes cattails, tules, and pondweeds. Semipermanent wetlands are frequently the low portions of seasonal wetlands that remain flooded after seasonal wetlands have dried or are drained. This type of wetlands management maintains exposed surface water on the site for 8 to 12 months annually and provides important summer water and brood ponds for resident waterfowl and other wildlife.

Seasonal wetlands are flooded in fall and maintained through winter or spring but are drained or allowed to dry through summer. Moist soil plant areas are seasonal wetlands managed for high production of preferred waterfowl forage plants and invertebrates. These areas may be irrigated during summer to stimulate plant growth. Water regimes are selected for specific plant associations, including swamp timothy, watergrass, or smartweed.

Open Water. Open water in and near freshwater marshes and along rivers, oxbows, and quiet backwaters is dominated by floating and submerged aquatic species. These areas are generally unvegetated, except for occasional beds of aquatic plants. Common dominants include pondweeds, water-milfoil, waterweeds, duckweeds, bladderworts, and water lily. The open water zones of lakes and large rivers provide resting and escape cover for many species of waterfowl. Gulls, terns, kingfishers, osprey, and bald eagle hunt over open water. Insectivorous birds and bats feed over open water. Common mammals in open water include muskrat, beaver, and river otter (Mayer and Laudenslayer, 1988).

Agricultural Habitats

Many of the natural habitats in the Central Valley have been largely replaced by agricultural habitats. Six agricultural types were identified in the project area: pasture, orchard-vineyard, row crops, grain, rice, and cotton. The intensive management of agricultural lands, including disking, grazing, crop rotation, and the use of chemicals, reduces the value of these habitats for wildlife. However, many wildlife species have adapted to particular crop types and now use them for foraging and nesting. Compared to other agricultural crops, rice and grain crops are considered of high value for wildlife because waste grain is important to foraging wildlife species and flooded rice fields provide habitat similar to some natural wetlands. Compared to rice and grains, pasture and row crops provide moderate-quality habitat because of their limited cover and foraging opportunities. Orchard-vineyard and cotton crops provide low-quality wildlife habitat because of frequent disturbance that results in limited foraging opportunities and lack of cover.

Pasture. Pasture habitat consists of irrigated and unirrigated lands dominated by grasses and legumes. The vegetation composition of pastures varies with management practices, affecting the abundance and composition of wildlife. Irrigated pastures provide foraging and roosting opportunities for many shorebirds and wading birds, including black-bellied plover, killdeer, long-billed curlew, and white-faced ibis. Lightly grazed, unirrigated pastures provide forage for seed-eating birds and small mammals when the seeds ripen. Alfalfa grown in irrigated pastures provides high-quality foraging habitat for rodents. Small mammals occupying pasture habitat include California voles, Botta's pocket gophers, and California ground squirrels. Raptors, including red-tailed hawks, black-shouldered kites, and prairie falcons, prey upon rodents. Areas where alfalfa or wild oats have been recently harvested provide high-quality foraging habitat for raptors. Ground-nesting birds, such as ring-necked pheasant, waterfowl, and western meadowlark, occupy pasture habitat if adequate residual vegetation is present.

Orchard-Vineyard. Orchard-vineyard habitat consists of cultivated fruit or nut-bearing trees and grapevines. This habitat is planted in a uniform pattern and intensively managed. Understory vegetation is usually sparse; however, in some areas, grasses are allowed to grow between vineyard rows to reduce erosion. Wildlife species associated with vineyards include the deer mouse, mourning dove, and black-tailed hare. The nut crop from orchards provides feed for American crows, scrub jay, northern flicker, Lewis' woodpecker, and California ground squirrel. The fruit crops from orchards provide additional food for yellow-billed magpies, American robin, northern mockingbird, black-headed grosbeak, gray squirrel, raccoon, and mule deer.

Row Crops. Row crops include tomatoes, sugar beets, and melons. Intensive management and the use of chemicals to control pests in row crops limit their use by wildlife. Rodent species that forage in row crops include the California vole, deer mouse, and California ground squirrel. These rodent populations are preyed on by Swainson's hawks, red-tailed hawks, and black-shouldered kites.

Grain. Grains crops include barley, wheat, corn, and oats. Many of these crops are planted in fall and harvested in spring. Grain crops are intensively managed, and chemicals are often used to control pests and diseases. This management strategy reduces their value to wildlife; however, the young green shoots of these crops provide important foraging opportunities for such species as greater white fronted geese, tundra swans, wild pigs, and tule elk. Other species, including red-winged blackbirds, Brewer's blackbirds, ring-necked pheasants, waterfowl, and western harvest mice, feed on the seeds produced by these plants.

Rice. Cultivated rice in the Central Valley has some of the attributes found in seasonal wetlands; however, the intensive management of this habitat reduces many of the benefits found in pristine wetlands. Flooded rice fields provide nesting and foraging habitat for waterfowl and shorebirds. The grain produced by this crop provides important forage for many wildlife species. After harvest, waterfowl (e.g., mallards and Canada geese), sandhill cranes, California voles, and deer mice feed upon the waste grain. Raptors, including northern harriers, black-shouldered kites, and ferruginous hawks, feed upon rodents in this habitat. Irrigation ditches used to flood rice fields often contain dense cattail vegetation and provide habitat for wildlife species, such as the Virginia rail, American bittern, snowy egret, marsh wren, common yellowthroat, and song sparrow.

Cotton. Cotton is of limited value to wildlife because of the intensive management of this crop and the use of chemicals to control pests and disease. Mourning doves and house mice are found in this crop type. During irrigation when vegetation is short and sparse, additional wildlife, including killdeer, American pipet, and horned lark, may be attracted.

SPECIAL-STATUS SPECIES

This section discusses special-status species that may occur in the project area. Two main sources were used to develop a list of threatened and endangered species that may potentially occur in the project area: the California Natural Diversity Database (CDFG, 1999) and the U.S. Fish and Wildlife Service Endangered Species Division, Sacramento, California (Appendix B).

Special-Status Fish

Several special-status fish species, including both anadromous and resident species, are found in the San Joaquin River and other streams located within the study area (Table 4.10-1). However, special-status fish species are not present in the project area.

Table 4.10-1
Special-Status Fish Species in the Project Area

Scientific/Common Name	Federal Status	State Status
Lampetra hubbsi/Kern brook lamprey	SC	SC
*Mylopharodon conocephalus/*Hardhead	--	SC
*Pogonichthlys macrolepidotus/*Sacramento splittail	T	SC
Oncorhynchus tshawytscha/Chinook salmon	T	SC
Oncorhynchus mykiss/Steelhead trout	T	SC
*Oncorhynchus clarki herishawi/*Lahontan cutthroat trout	T	SC
*Oncorhynchus clarki seleniris/*Paiute cutthroat trout	T	SC

Source: CDFG, 1999.

Legend: SC = species of concern; T = threatened; -- = no special-status

Special-Status Plants

Several special-status plant species are present in the San Joaquin Valley (Table 4.10-2). Most of these species are present in the grassland vegetation, particularly vernal pools. Several special-status plant species are present in Alkali Desert Scrub habitat and two species are present in the Freshwater Emergent Wetland community. Only five of the species listed in Table 4.10-2 are or may be present in the project area. The rest of the special-status plant species are located in foothill habitats, on the eastern edge of the Central Valley, or north and south of the project area.

Table 4.10-2
Status and Habitat of Special-Status Plant Species in the Project Area

Scientific/ Common Name	Status Federal	State	CNPS*	Habitat	Comments
Amsinckia grandiflora/ Large-flowered fiddleneck	FE	CE	1B	Valley grassland	Not known to be present in project area. Endemic to eastern foothills of the Diablo range.
Brodiaea pallida/ Chinese Camp brodiaea	__	CE	1B	Valley grassland (vernal streambeds)	Not known to be present in project area. Only one occurrence in Tuolumne County.
Castilleja campestris succulenta/ Succulent owl's clover	FT	CE	1B	Vernal pools	Not known to be present in project area. Endemic to eastern edge of the central San Joaquin Valley.
Caulanthus californicus/ California jewelflower	FE	CE	1B	Valley grassland and alkali desert scrub	Not known to be present in project area. Endemic to southern San Joaquin Valley.
Chamaesyce hooveri/ Hoover's spurge	FT	__	1B	Vernal pools	Not known to be present in project area. Endemic to eastern Sacramento and San Joaquin Valleys.
Cordylanthus mollis mollis/ Soft birds-beak	PE	CR	1B	Marshes and swamps	Present on San Luis National Wildlife Refuge.
Cordylanthus palmatus/ Palmate-bracted bird's-beak	FE	CE	1B	Valley grassland and alkali desert scrub	Potentially present in southern portion of study area.
Eriastrum hooveri/ Hoover's eriastrum	FT	__	4	Valley grassland and alkali desert scrub	Known populations south of study area
Eryngium racemosum/ Delta button-celery	__	CE	1B	Valley grassland (riparian scrub)	Present in San Luis and Merced National Wildlife Refuges.
Gratiola heterosepala/ Boggs Lake hedge-hyssop	__	CE	1B	Valley grassland and freshwater emergent wetland	Not known to be present in Project area. Endemic to eastern Sacramento and San Joaquin Valleys.
Lasthenia conjugens/ Contra Costa goldfields	PE	__	1B	Valley grassland (vernal pools)	Not known to be present in project area. Known to occur only at a few locations in Solano and Napa Counties.
Lembertia congdonii/ San Joaquin woolythreads	FE	__	1B	Valley grassland and alkali desert scrub	Potentially present in southern portion of study area.
Lilaeopsis masonii/ Mason's liaeopsis	__	CR	1B	Valley riparian and freshwater emergent wetland	Not known to be present in project area. Range north of study area.
Neostapfia colusana/ Colusa grass	FT	CE	1B	Valley grassland (vernal pools)	Present in the San Joaquin River National Wildlife Refuge.
Orcuttia inaequalis/ San Joaquin Valley Orcutt grass	FT	CE	1B	Valley grassland (vernal pools)	Not known to be present in project area. Endemic to eastern San Joaquin Valley.
Orcuttia pilosa/ Hairy Orcutt grass	FE	CE	1B	Valley grassland (vernal pools)	Endemic to eastern Sacramento and San Joaquin Valleys.
Orcuttia tenuis/ Slender Orcutt grass	FT	CE	1B	Valley grassland (vernal pools)	Not known to be present in project area. Range north of study area.
Orcuttia viscida/ Sacramento Orcutt grass	FE	CE	1B	Valley grassland (vernal pools)	Not known to be present in project area. Endemic to Sacramento Valley.
Pseudobahia bahiifolia/ Hartweg's golden sunburst	FE	CE	1B	Valley grassland	Not known to be present in project area. Distribution limited to eastern side of San Joaquin Valley in Stanislaus County.
Pseudobahia peirsonii/ San Joaquin adobe sunburst	FT	CE	1B	Valley grassland	Not known to be present in project area. Endemic to eastern San Joaquin Valley.
Sanicula saxatilis/ Rock sanicle	__	CR	1B	Valley grassland	Not known to be present in project area. Endemic to Santa Clara and Contra Costa Counties.

Table 4.10-2
Status and Habitat of Special-Status Plant Species in the Project Area

Scientific/ Common Name	Status Federal	Status State	Status CNPS*	Habitat	Comments
Sidalcea keckii/ Keck's checkerbloom	C	__	1B	Valley grassland	Not known to be present in project area. Endemic to southern Sierra Nevada foothills.
Trifolium amoenum/ Showy Indian clover	PE	__	1B	Valley grassland	Not known to be present in project area. One known occurrence in Sonoma County.
Tuctoria greenei/ Greene's tuctoria	FE	CR	1B	Valley grassland (vernal pools)	Not known to be present in project area. Currently present in eastern Merced County.
Tuctoria mucronata/ Crampton's tuctoria	FE	CE	1B	Valley grassland (vernal pools)	Not known to be present in project area. Currently present in Solano County.
Verbena californica/ California vervain	PT	__	1B	Valley grassland	Not known to be present in project area. Currently present in Tuolumne County.

*California Native Plant Society

Federal:
FE = listed as endangered under the federal Endangered Species Act.
FT = listed as threatened under the federal Endangered Species Act.
PE = proposed for federal listing as endangered under the federal Endangered Species Act.
PT = proposed for federal listing as threatened under the federal Endangered Species Act.
C = candidate for federal listing.
-- = none of the above.

State:
CE = listed as endangered under the California Endangered Species Act.
CT = listed as threatened under the California Endangered Species Act.
CR = listed as rare under the California Endangered Species Act. This category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation.
-- = none of the above.

CNPS:
1B = List 1B species: rare, threatened, or endangered in California and elsewhere.
4 = List 4 species: plants of limited distribution.

Soft Bird's-Beak. Soft bird's-beak is an annual herb endemic to the northern shores of the San Francisco Bay. A dozen historical occurrences were known from Marin to Contra Costa Counties, where the counties border San Francisco Bay. Investigations in the San Joaquin Valley in the early 1990s detected soft birds-beak in the San Luis National Wildlife Refuge (Service, 2000a). Soft bird's-beak occurs in coastal salt marshes; however, specifics about the microhabitat requirements of the species are not known. Reasons for historical declines are probably related to urban development and pollution, coupled with the relative sensitivity of the species to changes in environmental conditions as evidenced by the extreme fluctuations in annual population size (Reclamation, 1997a).

Palmate-Bracted Bird's-Beak. Palmate-bracted bird's-beak is an annual herb endemic to moist lowlands in the Central and Livermore Valleys. Its original range was probably similar to its current range, but with more numerous populations. Today it occurs at the Delevan and Colusa National Wildlife Refuges, near the City of Woodland, in the Springtown alkali sink north of Livermore, in western Madera County, at Sacramento National Wildlife Refuge in Glenn County, and at the Alkali Sink Ecological Reserve in Fresno County adjacent to the Mendota Wildlife Management Area. Palmate-bracted bird's-beak is restricted to saline-alkali soils in relatively undisturbed, seasonally flooded, alkali sink scrub habitats, at elevations below 500 feet. Habitat for the species has been eliminated and degraded by conversion to agricultural and urban development, draining of seasonal wetlands, grazing, off-road vehicle use, and trash dumping.

Delta Button-Celery. Delta button-celery is an annual or perennial herb found in streamside thickets dominated by one or more willow species, as well as by other fast-growing shrubs and vines. Most plants colonize vernally mesic clay depressions following flood disturbance. Their life form is variable depending on environmental conditions. Today, its distribution is restricted to a small number of occurrences in Merced County and is threatened by agriculture and flood control. Delta button-celery is present in the project area on the Los Banos Wildlife Management Area.

San Joaquin Wooly-Threads. San Joaquin woolly-threads is an annual herb endemic to the southern San Joaquin Valley and surrounding hills. It grows in annual grasslands with sparse cover of saltbush on alluvial fans, often with sandy soil. Its original range extended from southern Fresno and Tulare Counties (excluding the Tulare Lake bed) to Bakersfield and Cuyama Valley. Existing populations are scattered throughout all but the eastern portion of this area. Most of the 20 existing populations are in the area of the Carrizo Plain. Throughout its range, most of its habitat has been eliminated by conversion to agriculture. Threats to remaining unprotected populations include heavy grazing (especially by sheep), oil field development, and possibly air pollution.

Colusa Grass. Colusa grass is endemic to the Sacramento and San Joaquin Valleys. Its historical distribution included Merced, Stanislaus, Solano, and Colusa Counties. Colusa grass is known to be present on the San Joaquin River National Wildlife Refuge and thought to be present on the San Luis National Wildlife Refuge (Service, 2000a). Colusa grass occurs in large or deep vernal pools with substrates of adobe mud. The primary reasons for decline in this species include the conversion of vernal pools to agricultural and developed lands, heavy grazing by cattle, and competition from introduced weedy species that tend to displace Colusa grass (Reclamation, 1997a).

Special-Status Wildlife

Because a large number of special-status wildlife species with state or federal status may occur in the San Joaquin Valley, a core list of special-status wildlife was selected for this study. Threatened, endangered, proposed, or candidate species with known occurrences in the project area and with the greatest potential to occur in the project area based on available habitat were included in this study. This core list of wildlife species, including common and scientific name, federal and state status, associated habitat, and breeding period, is presented in Table 4.10-3. Additional information on distribution, habitat, and life history for these species can be found in the CVPIA Draft PEIS (Reclamation, 1997a). Information on special-status species high-priority needs within the CVP is included as Attachment H to the CVPIA Draft PEIS.

Table 4.10-3
Status and Habitat of Special-Status Wildlife Species Potentially Occurring in the Project Area

Common Name/ Scientific Name	Status Federal/State	Habitat/Comments
Invertebrates		
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/--	Completely dependent on its host plant, elderberry (*Sambucus* spp.), a common component of riparian forests, grasslands, and adjacent foothills of the Central Valley up to 3,000 feet. Adults are present from March through early June with peak activity in May.
Crustaceans		
Longhorn fairy shrimp *Branchinecta longiantenna*	E/--	Vernal pools. Species detected in spring and early summer while suitable habitats contain water.
Vernal pool fairy shrimp *Branchinecta lynchi*	T/--	Endemic to the grasslands of the Central Valley and Central and South Coast Mountains. Inhabit small, clearwater sandstone-depression pools and grassy swales, earth slump, or basalt-flow depression pools. Detected in spring and early summer when suitable habitats contain water.
Amphibians		
California tiger salamander *Ambystoma californiense*	C/CSC	Prime habitat in California is annual grassland, but seasonal ponds or vernal pools are crucial to breeding. Permanent ponds or reservoirs are sometimes used.
California red-legged frog *Rana aurora draytonii*	T/CSC	Permanent pools of streams, marshes, or ponds with emergent or submerged vegetation. Breeds January to July.
Reptiles		
Blunt-nosed leopard lizard *Gambelia (=Crotaphytus) silus*	E/E	Suitable habitat is characterized by sparsely vegetated scrub and grassland habitats in areas of low topographic relief. In areas of high relief, distribution is usually confined to broad sandy washes.
Giant garter snake *Thamnophis gigas*	T/T	Primarily associated with marshes and sloughs, less with slow-moving creeks, and absent from larger rivers. Active from mid-March until October.
Birds		
Aleutian Canada goose *Branta canadensis leucopareia*	T/--	In winter, forages in fields in and near safe roosting areas on open water of lakes and ponds. Does not breed in California.

Table 4.10-3
Status and Habitat of Special-Status Wildlife Species Potentially Occurring in the Project Area

Common Name/ Scientific Name	Status Federal/State	Habitat/Comments
White-tailed kite *Elanus leucurus*	--/P	Forages in open grasslands, meadows, farmlands, and emergent wetlands. Nests from May to August in oak, willow, or other tree stands.
Swainson's hawk *Buteo swainsoni*	--/T	Riparian areas and oak savannah with few trees. Breeds late March to mid-August.
Mammals		
San Joaquin Valley woodrat *Neotoma fuscipes riparia*	PE/--	Prefers riparian forest habitats with moderate canopy, year-round greenery, a brushy understory, and suitable nest-building materials. Houses are built of sticks and leaves at the base of or in a tree or around a shrub.
Riparian brush rabbit *Sylvilagus bachmani riparius*	PE/E	Dense brush cover of thickets, vines, brambles, or dense riparian species form the center of the brush rabbit life. Blackberry and willow patches are favored covers.
San Joaquin kit fox *Vulpes macrotis mutica*	E/T	Lives in annual grasslands or grassy open stages of vegetation dominated by scattered shrubs and scrub.
Giant kangaroo rat *Dipodomys ingens*	E/E	Found on fine sandy loam soils supporting sparse annual grass/forb vegetation, and marginally found in low-density alkali desert scrub.
Tipton kangaroo rat *Dipodomys nitratoides nitradoides*	E/E	Suitable habitat has widely scattered shrubs, annual forbs and grasses, and is distributed over broken terrain with small gullies and washes.
Fresno kangaroo rat *Dipodomys nitratoides exilis*	E/E	Gently undulating to level terrain with sandy loam soils, mildly to moderately alkaline, and herbaceous vegetation with scattered shrubs, appears to be suitable habitat.
San Joaquin antelope squirrel *Ammospermophilus nelsoni*	--/T	Prefers open areas in arid and semi-arid habitats; requires friable soil for burrowing. Uses hard-surfaced, rocky, or gravelly soils in open areas with clumps of shrubs.

T = Threatened
E = Endangered
PE = Proposed endangered
C = Candidate to become a proposed species
SOC = Federal Species of Concern
CSC = California Species of Special Concern.
P = State Protected species.

AREAS AFFECTED BY USE OF CVP WATER

All 20 of the contractors in the project area and several Significant Natural Areas use CVP water. The individual contractors, including all of the water districts and irrigation districts, the City of Tracy, and Reclamation District #1606, are described in Section 4.1. The following sections of the report describe several of the larger Significant Natural Areas affected by CVP water.

Significant Natural Areas

The 77 Significant Natural Areas in the San Joaquin Valley are scattered throughout the region, but are concentrated in the grasslands of the San Joaquin Valley in freshwater marsh, valley sink scrub, and grassland vernal pool habitats. These areas are important to waterfowl and shorebirds that winter and nest in the San Joaquin Valley, as well as for several special-status species, including the giant garter snake, Swainson’s hawk, tricolored blackbird, Colusa grass, Delta button celery, San Joaquin woolythreads, and soft birds-beak. In the southwestern portion of the valley, several Significant Natural Areas support special-status species (e.g., the giant kangaroo rat, blunt-nosed leopard lizard, Swainson’s hawk, and San Joaquin antelope squirrel) and habitats (e.g., valley needlegrass grassland and northern vernal pool habitats).

Historically, the San Joaquin basin was a large floodplain of the San Joaquin River that supported vast expanses of permanent and seasonal marshes, lakes, and riparian areas. Almost 70 percent of the basin has been converted to irrigated agriculture, with wetland acreage reduced to 120,300 acres. In combination with the adjacent uplands, the wetland complex is referred to as “the Grasslands” and consists of 160,000 acres of private and public lands. Approximately 53,300 acres of the Grasslands are permanently protected in state or federal wildlife refuges or in federal conservation easements.

Several Significant Natural Areas are present in the project area or are located nearby. Significant Natural Areas present in the project area include the Lower Cottonwood, Mendota, O'Neill Forebay, and Upper Cottonwood Creek Wildlife Management Areas. Significant Natural Areas present in the near vicinity of the Project area include Los Banos Wildlife Management Area, Little Panoche Wildlife Management Area, Merced National Wildlife Refuge, North Grasslands Wildlife Management Area, San Joaquin River National Wildlife Refuge, San Luis National Wildlife Refuge, and Volta Wildlife Management Area.

Los Banos Wildlife Management Area. The Los Banos Wildlife Management Area was the first waterfowl refuge established in California (Reclamation, 1997a). The refuge encompasses approximately 5,586 acres of the San Joaquin River floodplain and is located approximately 10 miles east of the Centinella Water District. It maintains approximately 3,200 acres of seasonal and permanent wetlands and 213 acres of alkali sink habitat. The Los Banos Wildlife Management Area provides habitat for a variety of bird species, including ducks, geese, shorebirds, coots, wading birds, and cranes. Pintail ducks and lesser snow geese are the most common waterfowl on the refuge. Swainson's hawks are known to nest near the refuge and to use the refuge for foraging. Other special-status species known to occur on the refuge include the giant garter snake and delta button celery.

Mendota Wildlife Management Area. The 12,425-acre Mendota Wildlife Management Area is the largest publicly-owned and managed wetland in the San Joaquin Valley (Reclamation, 1997a). Established between 1954 and 1966, the refuge is located on a part of the Coelho Family Trust and is adjacent to the Fresno Slough Water District, the Mardelia Hughes property, Reclamation District #1606, Tranquillity Irrigation District, and the 900-acre Alkali Sink Ecological Reserve. Approximately 8,300 acres of wetlands are maintained on the refuge, including almost 6,800 acres of seasonal wetlands. The water used to maintain these seasonal wetlands is purchased directly from the CVP (Huddleson, 2000). Migratory ducks and shorebirds utilize the seasonal wetland habitat present on the Mendota Wildlife Management Area. To feed these animals, several crops, including corn, barley, milo, and safflower, are raised. Giant garter snakes have been observed on the refuge.

Merced National Wildlife Refuge. The Merced National Wildlife Refuge was established in 1951 to alleviate crop depredation and provide waterfowl habitat (Reclamation, 1997a). The 2,562-acre refuge is one of the most important wintering areas in California, supporting snow and Ross' geese, sandhill cranes, and variety of shorebirds. Delta button-celery, a state candidate endangered species, is also present on the refuge. The refuge maintains approximately 1,232 acres of wetlands, of which approximately 730 acres are in moist soil plant management. A total of 550 acres is in cereal grain production, primarily alfalfa and corn. The Merced National Wildlife Refuge is located approximately 13 miles east of the Del Puerto Water District.

North Grasslands Wildlife Management Area. The North Grasslands Wildlife Management Area was purchased by the State of California in April 1990 and is managed by the California Department of Fish and Game (Reclamation, 1997a). It is located within five miles of the Del Puerto Water District and includes three separate units. The China Island and Salt Slough units contain 5,556 acres of primarily agricultural land and pasture, but also have extensive river and slough channels with riparian edges. These two units receive water directly from the CVP (Wilbur, 2000); however, the Salt Slough unit does not have a firm historical water supply. North Grasslands Wildlife Management Area provides habitat for a variety of wildlife species. Ducks are the most common waterbirds using the refuge, but sandhill cranes, shorebirds, and geese, including the Aleutian Canada goose, are also common. Agricultural crops irrigated with water from the Delta-Mendota Canal feed wintering migratory birds.

San Luis National Wildlife Refuge. The 7,340-acre San Luis National Wildlife Refuge is located approximately six miles east of the Del Puerto Water District. The refuge is a complex of wetland, upland, and riparian habitat, with approximately 2,700 acres of wetlands managed for moist soil plant production (Reclamation, 1997a). Of the 3,940 acres of grasslands, 145 acres of native grassland are preserved as a rare ecological community. The San Luis National Wildlife Refuge buys water from the CVP to irrigate seasonal wetlands and cereal crops (Chouinard, 2000). The refuge provides habitat for waterfowl, including ducks, geese, and shorebirds, as well as tule elk and other endangered species. Soft birds-beak, a federal proposed endangered plant species, and delta button-celery are both present on the San Luis National Wildlife Refuge.

San Joaquin National Wildlife Refuge. The San Joaquin National Wildlife Refuge is located approximately 10 miles west of Modesto on Highway 132 and the San Joaquin River. No public access currently exists. The refuge consists of approximately 800 acres of San Joaquin River riparian habitat. Primary wildlife at the refuge includes the endangered Aleutian Canada goose, as well as ducks, sandhill cranes, migratory nongame songbirds, and colonial nesting birds.

Volta Wildlife Management Area. The 3,000-acre Volta Wildlife Management Area is located approximately five miles east of the Centenella Water District. The refuge maintains more than 1,800 acres of wetlands, including 1,400 acres of moist soil plants, and 720 acres of alkali sink habitat are preserved on the refuge as a rare ecological community (Reclamation, 1997a). The Volta Wildlife Management Area provides habitat for a variety of bird species, including ducks, geese, shorebirds, coots, and wading birds. Black-necked stilts, sandpipers, dunlins, and dowitchers dominate shorebird species.

AREAS NOT AFFECTED BY USE OF CVP WATER

Four natural areas in the vicinity of the project area that are managed as uplands do not receive water from the Delta-Mendota Canal (Wilbur, 2000). These areas include the Little Panoche, Lower Cottonwood Creek, O'Neill Forebay, and Upper Cottonwood Creek Wildlife Management Areas. Upper and Lower Cottonwood Creek Wildlife Management Areas are located adjacent to San Luis Reservoir. O'Neill Forebay Wildlife Management Area is located adjacent to its namesake. The Little Panoche Wildlife Management Area is located on Little Panoche Creek in the hills approximately 10 miles southwest of the Eagle Field Water District.

EXISTING GENERAL PLAN PROTECTIVE AND MANAGEMENT MEASURES

In addition to the measures required under the Endangered Species Act to protect listed and proposed species, other measures to mitigate or offset impacts to sensitive and special-status species have been developed and implemented by the cities and counties in the project area as part of their general plans. Some of these goals and policies are currently being reviewed and modified by city and county agencies as part of the general plan EIR process. The most current measures for the affected cities and counties in the project area are described below.

Stanislaus County

The Conservation/Open Space Element of the Stanislaus County General Plan support documentation emphasizes the conservation and management of economically productive natural resources and conservation of open space lands (any parcel or area of land or water that is essentially unimproved). The element (1) promotes the protection, maintenance, and use of the county’s natural resources, with special emphasis on scarce resources and those that require special control and management; (2) prevents wasteful exploitation, destruction, and neglect of natural resources; (3) recognizes the need for natural resources to be maintained for their ecological values as well as for their direct benefit to people; (4) preserves open space lands for outdoor recreation including scenic, historic, and cultural areas; and (5) preserves open space for public health and safety, including areas subject to landslides, flooding, and high fire risk, and areas required for the protection of water and air quality.

Goal One encourages the protection and preservation of natural and scenic areas throughout the county by:

- Maintaining the natural environment in areas dedicated as parks and open space
- Ensuring compatibility between natural areas and development
- Protecting from development areas of sensitive wildlife habitat and plant life (e.g., vernal pools, riparian habitats, flyways, and other waterfowl habitats, etc.) including those habitats and plant species listed in the General Plan Support Documentation or by state or federal agencies
- Protecting and enhancing oak woodlands and other native hardwood habitat

San Joaquin County

Implementing the Natural Resources Regulations as identified in the Draft General Plan 2010 would protect important biotic resources within San Joaquin County. The county's policies and implementation measures related to the protection and management of biological resources include special-status species, sensitive natural communities, and fisheries.

The Final EIR on the San Joaquin County Comprehensive Planning Program (Baseline, 1992) recommends that the county develop an integrated vegetation management program for properties owned and maintained by the county. Additionally, the Final EIR recommends protecting habitat areas large enough to be minimally affected by urban development including maintaining connection of habitat and restoring and enhancing degraded ecosystems such as historic salmon runs on the Mokelumne and Calaveras Rivers.

City of Tracy

The City of Tracy plans to conserve natural resources through the protection and enhancement of permanently preserved open space. For actions associated with the policies listed below, refer to *City of Tracy General Plan: An Urban Management Plan* (City of Tracy, 1993).

The City of Tracy recognizes Old River, Tom Paine Slough, and Paradise Cut as important open space resources for habitat conservation and recreational opportunities. It also will minimize impacts of development on waterways, riparian corridors, and adjacent buffer areas and will seek opportunities to preserve or establish wildlife habitat, in conjunction with other uses and developments within the Tracy Urban Management Plan Area.

Fresno County

Policies in the Fresno County General Plan seek to protect riparian and wetland habitats while allowing compatible uses where appropriate. Related policies are included in Section LU-C, River Influence Areas; Section OS-A, Water Resources; Section OS-E, Fish and Wildlife Habitat; and Section OS-F, Vegetation.

- To conserve the function and values of wetland communities and related riparian areas throughout Fresno County while allowing compatible uses where appropriate. Protection of these resource functions positively affect aesthetics, water quality, floodplain management, ecological function, and recreation/tourism. Policies in this section seek to protect natural areas and to preserve the diversity of habitat in the county. Related policies are included in Water Resources, Forest Resources, Wetland and Riparian Areas, Vegetation, and River Influence Areas elements.

- To help protect, restore, and enhance habitats in Fresno County that support fish and wildlife species so that populations are maintained at viable levels. Policies in this section seek to protect native vegetation resources primarily on private land within the county.

- To preserve and protect the valuable vegetation resources of Fresno County.

For more detailed information on the direction of the goals listed below, refer to the Fresno County General Plan Background Report (County of Fresno, 2000a).

City of Fresno

Currently, the City of Fresno has three main objectives for conservation of natural resources (City of Fresno, 2000).

- To provide for long-term preservation, enhancement, and enjoyment of plant, wildlife, and aquatic habitat resources in the Fresno area by protecting, improving, and restoring these resources.

- Maintain and restore, where feasible, the ecological values of the San Joaquin River corridor, because (1) this area is Fresno's main scenic feature and natural area; (2) it is important for maintenance of good-quality water resources in the region; and (3) it constitutes unique, irreplaceable habitat for valley native species.

- Support the San Joaquin River Conservancy in its efforts to develop a river parkway that strikes an appropriate balance between facilitating recreational pursuits; protecting water resources; meeting economic and development needs through sand and gravel production; and long-term preservation, enhancement, and public enjoyment of the river's unique and irreplaceable plant, wildlife, and aquatic resources.

For more information on the policies associated with these objectives, refer to the Draft 2000 Fresno General Plan (City of Fresno, 2000).

Merced County

Merced County has the following goals and objectives regarding conservation of natural resources.

- Habitats that support rare, endangered, or threatened species are not substantially degraded. Rare and endangered species are protected from urban development and are recognized in rural areas.

- Local, state, and federal managed lands are recognized.

For more information on the policies developed for these goals and objectives, refer to the Merced County Year 2000 General Plan (Merced County, 1990a).

ENVIRONMENTAL CONSEQUENCES

Impacts to biological resources would be considered adverse if special-status species or their habitats, as designated by federal, state, or local agencies, were affected directly or indirectly by project-related activities. In addition, impacts to biological resources would be considered significant if substantial loss, reduction, degradation, disturbance, or fragmentation occurred in native species habitats or in their populations. These impacts could be short- or long-term impacts. For example, short-term or temporary impacts may occur during project implementation, and long-term impacts may result from the loss or change of vegetation and thereby loss of the capacity of habitats to support wildlife populations.

NO-ACTION ALTERNATIVE

Requirements of the CVPIA Biological Opinion being prepared (Reclamation and Service, 2000) would be met under the No-Action Alternative, including continuation of ongoing conservation programs for special-status species. The renewal of long-term contracts would not involve construction of new facilities or installation of structures that would alter current land uses. The renewal of CVP contracts for the project area would only continue water deliveries that accommodate the land uses identified in Section 4.4. Implementation of the No-Action Alternative would not impact the production of agricultural crops or existing land uses. No habitat that supports special-status species would be converted to agricultural, municipal, or industrial use. As a result, renewal of the water service contracts under the No-Action Alternative would not result in adverse effects on fish, vegetation, or wildlife resources located in the Delta-Mendota Canal Unit.

ALTERNATIVE 1

Similar to the discussion above for the No-Action Alternative, Alternative 1 would not result in adverse impacts on biological resources, including fish, vegetation, and wildlife, in the Delta-Mendota Canal Unit project area. The renewal of CVP contracts for the project area would only continue water deliveries that accommodate the land uses identified in Section 4.4. Implementation of Alternative 1 would not substantially impact the production of agricultural crops or existing land uses. No habitat that supports special-status species would be converted to agricultural, municipal, or industrial use.

ALTERNATIVE 2

Similar to the discussion above for the No-Action Alternative, Alternative 2 would not result in adverse impacts on biological resources, including fish, vegetation, and wildlife, in the Delta-Mendota Canal Unit project area. The renewal of CVP contracts for the project area would only continue water deliveries that accommodate the land uses identified in Section 4.4. Implementation of Alternative 2 would not substantially impact the production of agricultural crops or existing land uses. No habitat that supports special-status species would be converted to agricultural, municipal, or industrial use.

CUMULATIVE IMPACTS

Cumulative impacts on a CVP-wide basis are addressed in the CVPIA PEIS. Beyond those cumulative impacts, there are no additional impacts attributable to Alternative 1 or 2 that would contribute to cumulative biological impacts.

SECTION 4.11: CULTURAL RESOURCES

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on cultural resources in the Delta-Mendota Canal Unit.

AFFECTED ENVIRONMENT

Renewal of the water service contracts between Reclamation and the 20 districts comprising the Delta-Mendota Canal Unit constitutes an "undertaking," under federal definitions. In general, the potential to impact cultural resources derives primarily from the possibility that existing land uses, which are primarily agricultural, could change over time. Potential impacts to cultural resources may result from a variety of demographic, economic, and political factors.

The potential for impacts to cultural resources must be considered in the environmental review document being prepared for the renewal of water service contracts, in compliance with a number of state and federal rules and regulations (see the Regulatory Setting discussion below). This section of the EA has been prepared to meet both federal and state requirements, in accordance with NEPA and CEQA provisions.

For cultural resources, the area of potential effect consists of the contract service areas for the 20 water districts. The district service areas, which are described in Section 4.1 of this EA, incorporate extensive areas along the western portion of the San Joaquin Valley and the interface between the valley and the lower reaches (eastern margin) of the Diablo Range.

The remainder of this section details the potential effects of the undertaking to cultural resources that are considered eligible or potentially eligible for inclusion on the National Register of Historic Places (NRHP) or significant per CEQA and that are located or may be present within the 20 water service districts. Included at the end of this section are recommendations for actions and procedures to be made part of the final water service contracts that, if adopted, will ensure that project effects are reduced to less than adverse levels.

INFORMATION SOURCES AND BACKGROUND DATA FOR AFFECTED ENVIRONMENT

This section provides a brief overview of environmental, prehistoric, ethnographic and historic context for the area encompassed by the Delta-Mendota Canal Unit. Much of this background information derives from anthropological, archaeological, and historic studies conducted over the past several decades on both public and private lands within the contract service areas. Also discussed are the types of cultural resources known or suspected of being present within the 20 water service districts.

In order to secure information concerning the types and general distribution of known archaeological and historic sites and to estimate whether additional such sites may remain undiscovered within individual district lands, the following sources were consulted:

- A search of archaeological survey, site and other records and documents maintained by the California Historical Resources Information System, Central California Information Center (CSU-Stanislaus) and the Southern San Joaquin Valley Information Center (CSU-Bakersfield).
- A review of selected published and unpublished archaeological, ethnographic and historic reports and documents available for the overall project area.
- A review of the NRHP.
- The California Register of Historical Resources.
- The California Inventory of Historic Resources (1976).
- The California Historical Landmarks (1996).
- The California Points of Historical Interest listing (May 1992 and updates).
- The Historic Property Data File (Office of Historic Preservation current list).
- The CALTRANS Local Bridge Survey (1989).
- The Survey of Surveys (1989).

The background research and records searches were undertaken in September 2000, with specific results summarized below under Natural Environmental Context, Cultural Environmental Context, and Current Inventory of Cultural Resources.

Natural Environmental Context

The 20 water contract service areas (districts) comprising the Delta-Mendota Canal Unit include primarily valley and lower foothill lands located within the central and southern San Joaquin Valley, along the western margin of the valley at the interface of the valley and the lower reaches of the Diablo Range.

This area contains a variety, but a limited number of water sources and resource zones. Prehistoric use and occupation focused on these features, particularly around the confluences of streams and within the ecotones created at the interface of foothill/valley lands. Drainages and associated natural levees and benches were moderately to intensively utilized, while uplands were visited for oak and other resources on a more seasonal basis.

Much of this area has been affected by ranching for over 100 years and agriculture during the past 50 to 100 years. The most recent impacts derive primarily from the construction of water distribution facilities, major transportation routes (Interstate 5 in particular), and agricultural equipment and storage buildings.

Overall environmental conditions throughout the project area have remained generally stable throughout the past 8,000 to 10,000 years, although minor to moderate fluctuations in precipitation and temperature that may have affected prehistoric patterns of land use and settlement have been documented elsewhere for a portion of the Great Valley of California (West, 1977; Moratto, King, and Woolfenden, 1978).

Prehistoric Context

The CVPIA project area has a long and complex cultural history with distinct regional patterns that extends back more than 11,000 years. The first generally agreed-upon evidence for the presence of prehistoric peoples in the CVPIA area is represented by the distinctive fluted spear points, termed Clovis Points, found on the margins of extinct lakes in the San Joaquin Valley. The Clovis points are found on the same surface with the bones of extinct animals such as mammoths, sloths, and camels. Based on evidence from elsewhere, the ancient hunters who used these spear points existed during a narrow time range of 10,900 BP to 11,200 BP.

The next cultural period represented, the Western Pluvial Lakes Tradition, thought by most to be subsequent to the Clovis period, is another widespread complex that is characterized by stemmed spear points. This poorly defined early cultural tradition is regionally known from a small number of sites in the Central Coast Range, San Joaquin Valley lake margins, and Sierra Nevada foothills. The cultural tradition is dated to between 8,000 and 10,000 years ago and its practitioners may be the precursors to the subsequent cultural pattern.

About 8,000 years ago, many California cultures shifted the main focus of their subsistence strategies from hunting to seed gathering as evidenced by the increase in food-grinding implements found in archeological sites dating to this period. This cultural pattern is best known for southern California, where it has been termed the Milling Stone Horizon (Wallace, 1954, 1978), but recent studies suggest that the horizon may be more widespread than originally described and is found throughout the CVPIA area. Radiocarbon dates associated with this period vary between 8,000 and 2,000 BP, although most cluster in the 6,000 to 4,000 BP range (Basgall and True, 1985).

Cultural patterns as reflected in the archeological record, particularly specialized subsistence practices, became codified within the last 3,000 years. The archeological record becomes more complex, as specialized adaptations to locally available resources were developed and populations expanded. Many sites dated to this time period contain mortars and pestles and/or are associated with bedrock mortars implying the intense exploitation of the acorn. The range of subsistence resources utilized and exchange systems expanded significantly from the previous period. Along the coast and in the Central Valley, archeological evidence of social stratification and craft specialization is indicated by well-made artifacts such as charmstornes and beads, often found as mortuary items. Ethnographic lifeways serve as good analogs for this period.

Ethnographic Context

As noted above, the overall project area is nearly coterminous with lands claimed by the Penutian-speaking Northern Valley Yokuts at the time of initial contact with European American populations circa AD 1850 (Kroeber, 1925; Wallace, 1978). These Yokuts occupied an area extending from the crest of the Coast Diablo Range easterly into the foothills of the Sierra Nevada, north to the American River, and south to the upper San Joaquin River.

The basic social unit for the Yokuts was the family, although the village may also be considered a social, as well as a political and economic unit. Often located on flats adjoining streams, villages were inhabited mainly in the winter because it was necessary to go out into the hills and higher elevation zones to establish temporary camps during food-gathering seasons (i.e., spring, summer, and fall). Villages typically consisted of a scattering of small structures, numbering from four or five to several dozen in larger villages, each house containing a single family of from three to seven people. Larger villages, with from twelve to fifteen or more houses, might also contain an earth lodge.

As with most California Indian groups, economic life for the Yokuts revolved around hunting, fishing, and collecting plants, with deer, acorns and avian and aquatic resources representing primary staples. The Yokuts used a wide variety of wooden, bone, and stone artifacts to collect and process their food. The Yokuts were very knowledgeable in terms of the uses of local animals and plants and the availability of raw materials that could be used to manufacture an immense array of primary and secondary tools and implements. However, only fragmentary evidence of their material culture remains, due in part to perishability and in part to the impacts to archaeological sites resulting from later (historic) land uses.

Resource Considerations, Native American Sites. The discussion of regional prehistory and ethnography provides insight into the types of Native American sites already known or likely to be present within the project area, with the most frequently occurring types including the following:

- Large village sites located along the margins of all permanent streams, particularly at confluences, and other natural surface water sources (springs, marshes and other wetlands). Additional large village sites have been documented along smaller stream courses, especially where streams merge, and particularly at the interface between major ecotones.
- Surface scatters of lithic artifacts without buried cultural deposits, resulting from short-term occupation and/or specialized economic activities.
- Petroglyphs, often in the form of cupped boulders, at or close to village sites or encampments.
- Bedrock food-processing (milling) stations, including mortar holes and metate slicks.
- Trails, often associated with migratory game animals.
- Mortuary sites, often but not exclusively associated with large village complexes.
- Isolated finds of aboriginal artifacts and flakes.

Historic Context

Interior California was initially visited by Anglo-American fur trappers, Russian scientists, and Spanish-Mexican expeditions during the early part of the twentieth century. These early explorations were followed by a rapid escalation of European-American activities, which culminated in the massive influx fostered by the discovery of gold at Coloma in 1848. The influx of miners and others during the gold rush set in motion a series of major changes to the natural and cultural landscape of California that would never be reversed.

Early Spanish expeditions arrived from Bay Area missions as early as 1804, penetrating the northwestern San Joaquin Valley (Cook, 1976). By the mid-1820s, hundreds of fur trappers were annually traversing the valley on behalf of the Hudson's Bay Company (Maloney, 1945). By the late 1830s and early 1840s, several small permanent European-

American settlements had emerged in the Central Valley and adjacent foothill lands, including ranchos in the interior Coast Range.

With the discovery of gold in the Sierra Nevada, large numbers of European-Americans, Hispanics, and Chinese arrived in and traveled through the general project area. The mining communities' demand for hard commodities led quickly to the expansion of ranching and agriculture throughout the valley and logging within the foothill and higher elevation zones of the Sierra Nevada. Stable, larger populations arose and permanent communities slowly emerged in the Central Valley at this time, particularly along major transportation corridors. Of particular importance was the transformation brought about by construction of railroad lines.

The Southern Pacific and Central Pacific Railroads and a host of smaller interurban lines to the north around the city of Stockton began intensive projects in the late 1860s. By the turn of the century, nearly 3,000 miles of lines connected the cities of Modesto and Stockton with points south and north. Many of the valley's larger cities, including many in San Joaquin County and adjacent counties, were laid out as isolated railroad towns in the 1870s and 1880s by the Southern Pacific, which not only built and settled, but continued to nurture the infant cities until settlement was successful. The Southern Pacific main line proceeds through or adjacent to the entire project area.

Intensive agricultural development soon followed, since railroads provided the means for product to be transported to a much larger market. By the end of the twentieth century, a substantial portion of the valley was being intensively cultivated, with increasing mechanization through all of the twentieth century and substantial expansion of cultivated acreage with the arrival of water from the CVP.

Resource Considerations, Historic Resources. Historic overviews for the region generally document the presence of a wide range of historic site and feature types and complexes, with types known or most likely to be present with the project area including the following:

- Historic railroad alignments.
- Two-track historic trails/wagon roads and now-paved historic road corridors.
- Water distribution systems, including levees and small and large ditch, canal, and channel systems.

- Occupation sites or homesteads and associated features such as refuse disposal sites, privy pits, barns, and sheds.
- Commercial undertakings.
- Refuse disposal site(s) associated with early communities.
- Ranch features, including standing structures, structural remnants, stock ponds, and corrals.

CURRENT INVENTORY OF CULTURAL RESOURCES

A total of 89 archaeological and historic sites are currently documented within the contract service areas of the 20 districts comprising the Delta-Mendota Canal Unit. These include sites that contain exclusively prehistoric material, sites with only historic material, sites with mixed prehistoric/historic components, and structures.

Prehistoric sites are represented by large habitation areas (village sites) in which both habitation and special-use activity areas are represented; mortuary sites, usually associated with habitation sites; specialized food-procurement and food-processing sites including milling areas; and other site types representing a variety of specialized activities.

Historic sites are represented by a range of types, including buildings and structures dating to the twentieth century; historic transportation features; water distribution systems; occupation sites and homesteads with associated features such as refuse disposal sites, privy pits, barns, and sheds; historic disposal sites associated with historic communities; and ranch complexes.

Many of these prehistoric and historic sites have already been determined eligible or are considered potentially eligible for inclusion on the NRHP. Others remain unevaluated in relation to NRHP eligibility criteria.

In addition to formally recorded sites, it is clear that a large number of both prehistoric and historic sites remain undiscovered within the overall project area simply because for many areas, especially undeveloped ranch and farm lands, a formal archaeological inventory survey has never been undertaken.

In addition to archaeological sites of both prehistoric and historic-era affiliation, isolated artifacts have also been identified at numerous locations throughout the overall project area. *Isolates* are defined as single formed tools of prehistoric affiliation or portable historic artifacts and isolated historic features not associated with other cultural manifestations. By definition, such finds are not considered eligible for inclusion on the NRHP nor significant per CEQA.

Table 4.11-1 summarizes the current cultural resources inventory by district or contracting agency. The table also provides information concerning the cultural resource inventory within each district, as follows:

- The number of documented archaeological and historic sites that have been assigned State Trinomials, Primary Record, or State Landmark designations.
- An estimate of the land area within the district that has been surveyed for cultural resources.
- A conclusion as to whether district lands are known or are likely to be discovered to contain important prehistoric or historic sites or other cultural features. This conclusion or assessment is based on (a) the results of the formal records search, (b) previous consultation with Native American groups and historic societies as summarized in existing documents, (c) the results of prior surveys in the general or immediate vicinity, and (d) an assessment of archaeological sensitivity based on stream courses and other critical variables present within unsurveyed district lands.
- Additional actions that districts would have to take to ensure compliance with Section 106 of the National Historic Preservation Act if land use were to change substantially and thus potentially affect significant resources known to exist or that might remain as yet undiscovered within district lands.

Issues Identified

The primary issues involving cultural resources include (a) what types of archaeological and historic sites are present within the water service areas that could be affected by the undertaking, (b) what is the basis for determining the significance or importance of identified sites, (c) what effects might the undertaking have on important or significant sites located within the project areas, and (d) what steps might be taken to avoid, minimize, or mitigate any adverse impacts to such significant sites.

Table 4.11-1
Summary of Previous Studies and Cultural Properties

District Name	Recorded Sites and Landmarks*	Percentage Surveyed to Date	Are Undocumented Sites Likely To Be Present in District?	Are Specific Additional Cultural Studies Needed if Contracted Water Results in Changes to Existing Land Uses?
The West Side Irrigation District	7	30%	Yes	Yes
Plain View Water District	6	60%	Yes	Yes
City of Tracy	15	20%	Yes	Yes
Banta-Carbona Irrigation District	5	10%	Yes	Yes
West Stanislaus Irrigation District	3	1%	Yes	Yes
Patterson Water District	3	5%	Yes	Yes
Del Puerto Water District	22	35%	Yes	Yes
Centinella Water District	0	20%	Yes	Yes
Laguna Water District	0	0%	Yes	Yes
Eagle Field Water District	0	0%	Yes	Yes
Oro Loma Water District	0	0%	Yes	Yes
Mercy Springs Water District	0	0%	Yes	Yes
Widren Water District	0	1%	Yes	Yes
Broadview Water District	0	0%	Yes	Yes
Coelho Family Trust*	1	1%	Yes	Yes
Reclamation District #1606*	1	1%	Yes	Yes
Fresno Slough Water District	0	0%	Yes	Yes
Tranquillity Irrigation District*	1	2%	Yes	Yes
Mardelia Hughes Property	25	3%	Yes	Yes
James Irrigation District	0	25%	Yes	Yes
Total	**89**			

*District contains no sites with State Trinomial or DP number designations, but contains one State Historic Landmark herein counted as a "site."

The identification of archaeological sites was resolved through (a) evaluation of existing records and documents, including archaeological survey reports and archaeological site documents on file at California Historical Resources Information Centers and elsewhere, (b) archaeological and historic overview of the project area, and (c) the results of previous consultation with Native American groups and historic societies as documented in existing reports and files at California Information Centers.

The significance or importance of archaeological sites located within the project area has been addressed by using established procedures outlined in 36 Code of Federal Regulations (CFR) 60.4 and discussed below. As well, Section 15064.5 of CEQA was used to evaluate the significance of resources in compliance with California law.

The final cultural resource issue revolves around possible impacts to archaeological and historic sites that might be determined eligible or potentially eligible for listing on the NRHP and how best to minimize or reduce such possible impacts to less than adverse levels. These issues are discussed below under Potential Effects of the Undertaking to Cultural Resources and under Mitigation Measures.

REGULATORY SETTING

The proposed project constitutes an undertaking, according to federal definitions. The area of potential effect for cultural resources consists of the land areas within the contracted water service area boundaries. Within these service areas, there are previously documented and as yet undiscovered archaeological and historic sites, as well as areas of traditional cultural value. One or more of these documented or undiscovered sites or areas of traditional cultural value could be impacted by water contract renewal, if contract renewal were to produce a substantial change in land use.

Evaluation of the potential impacts of an undertaking to archaeological and historic sites must conform with Section 106 of the National Historic Preservation Act and its implementing regulations (36 CFR Part 800), Section 2(b) of Executive Order 11593, Section 101(b)(4) of NEPA, the Archaeological Resources Protection Act, the Native American Grave Protection and Repatriation Act of 1990, and other rules and regulations. Reclamation would not be directly associated with or responsible for ensuring compliance with these rules and regulations. However, Reclamation's contract to renew water deliveries would include provisions for ensuring such compliance by the water contract agencies.

Water service contract renewal also constitutes a project with the potential for adverse environmental effects pursuant to CEQA. Compliance with CEQA requires completing projects in conformity with the October 1998 amended guidelines. Compliance with CEQA is typically ensured by project-specific permitting activities that occur at the county or municipal level. In turn, these political subdivisions are guided by general plans or similar documents, as required by CEQA. These county and municipal plans are thus linked with the regulatory context of the present undertaking.

ENVIRONMENTAL CONSEQUENCES

The objectives of this section are (a) to describe the basis for determining which cultural resources located within the project area have been included, are considered potentially eligible for inclusion, or might be found to be eligible for inclusion on the NRHP or significant per CEQA and whether additional such resources may remain undiscovered within the service areas, (b) to identify and assess the potential effect of the project on eligible or potentially eligible or significant cultural resources, and (c) to outline appropriate measures that can be taken to avoid, minimize, or mitigate adverse impacts to any eligible cultural properties that could be affected by the undertaking.

SIGNIFICANCE OR IMPORTANCE OF CULTURAL RESOURCES

According to federal regulations and guidelines, significant or important cultural resources are those prehistoric and historic sites, districts, buildings, structures, and objects, as well as properties with traditional religious or cultural importance to Native Americans, that are listed or are eligible for listing on the NRHP (historic properties), according to the criteria outlined in 36 CFR 60.4. Historic properties must possess integrity of location, design, workmanship, feeling, and association and must meet at least one of the following criteria:

- Associated with events that have made significant contributions to the broad patterns of United States history.
- Associated with the lives of people significant in United States history.
- Embody the distinctive characteristics of a type, period, or method of construction; or represent the work of a master, or possess high artistic value or represent a significant and distinguishable entity whose components may lack individual distinction.
- Has yielded or is likely to yield information important in prehistory or history.

Archaeological sites with “cultural” or traditional value are evaluated under guidelines prepared by the Advisory Council on Historic Preservation entitled *Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review* (Draft Report, August 1985). The guidelines define *cultural value* as “...the contribution made by an historic property to an on-going society or cultural system. A traditional cultural value is a cultural value that has historical depth.” The guidelines further specify that “[a]...property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value.”

Criteria specified in Section 15064.5 of CEQA (October 1998 amended guidelines) suggest that important and potentially significant archaeological resources are ones that include or contain the following associations and/or attributes:

- Are associated with events that have made a significant contribution to the broad patterns of California’s history and cultural heritage;
- Are associated with the lives of persons important in our past;
- Embody the distinctive characteristics of a type, period, region, or method of construction, or represent the work of an important creative individual, or possess high artistic values; or

- Have yielded or may be likely to yield information important in prehistory or history.

Since most archaeological sites are evaluated with respect to their data potentials and research values, a site's NRHP eligibility and significance per CEQA are often determined on the strength of the data collected during the course of background studies and intensive field surveys. However, in many instances, it is discovered that surface manifestations alone are insufficient to fully evaluate the eligibility or significance of a particular resource. In such situations, subsurface archaeological testing may be necessary to augment the findings from surface observations made during site recording.

As noted above, although numerous archaeological and historic sites have been documented within the contract service areas (within individual district boundaries), only a relatively small percentage have been evaluated for NRHP eligibility or significance per CEQA. As well, intensive-level pedestrian surveys have been undertaken within only a portion of the overall water service contract areas. For these reasons, the mitigation measures discussed below include a recommendation that the water service contracts include specific procedures to ensure that unevaluated sites are adequately evaluated, undiscovered sites are identified, appropriate effect determinations are made, and adequate treatment options selected prior to affecting such resources.

POTENTIAL EFFECTS OF THE UNDERTAKING TO CULTURAL RESOURCES

Impacts to archaeological and historic sites occur from activities affecting the characteristics that qualify a property for inclusion on the NRHP or that render a site significant under CEQA. The criteria for assessing effects are available in the Advisory Council on Historic Preservation’s regulations for the protection of historic properties at 36 CFR 800.9. Significant impacts are those considered to have an adverse effect on historic properties. Adverse effects may include, but are not limited to:

- Physical destruction, damage, or alteration of all or part of a historic property.
- Isolation of a historic property or alteration of the character of its setting when that character contributes to the property’s eligibility for the NRHP or its cultural significance.
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or that alter its setting.

Important archaeological sites within the project area include documented and undocumented prehistoric and historic sites and features and groups of sites that qualify as

National Register Districts. Many contain subsurface (buried) accumulations of cultural material, as well as artifacts and lithic scatters on the surface within defined site boundaries. The importance of these components rests in part on the age and makeup of the cultural materials actually present at the sites, as well as the integrity of the spatial relationships, both vertical and horizontal, among these cultural materials. Thus, an adverse effect could occur as a result of breaking or otherwise destroying artifacts, as well as altering the contextual relationships among the artifacts and other cultural materials present. Direct construction impacts are typically more destructive than events such as inundation and farming.

Virtually all of the actions associated with the long-term renewal of the Delta-Mendota Canal Unit water service contracts are within the range of "existing conditions" with respect to land use. The area of use, types of use, range of river flows, and range of reservoir fluctuations fall within this range of existing conditions.

Currently, the majority of the lands within the districts is being farmed, an activity that has been ongoing for decades. There are presently no specific plans to modify or substantially alter current land use within district boundaries on the basis of renewal of the water delivery contracts with Reclamation.

MITIGATION MEASURES

As indicated above, contract renewal itself will not result in direct impacts to eligible or significant prehistoric or historic sites or districts within the project areas. However, contract renewal may indirectly affect such resources in combination with other demographic, economic, and/or political factors that consequently cause land use changes that in turn affect cultural resources. Specific uses of available water thus constitute actions that could contribute to affecting important cultural resources within the contract service areas.

Land use changes, including the addition of lands to districts or the conversion of land from agricultural to M&I use, are made at the local level, according to California land use planning law. There are no plans at the federal level to either add lands to districts or to effect land use conversions through the long-term contract renewal process. Because such decisions might only occur at the state or local level, the entities responsible at this level for potential impacts to cultural resources would be the 20 water districts comprising the Delta-Mendota Canal Unit.

The recommended mitigation measures are presented as a series of tasks that are to be complied with, where appropriate, by the contracting agencies. Such tasks are routinely required under county or municipal rules and regulations governing permitted construction and related activities, in compliance with CEQA. The tasks detailed below satisfy not only CEQA, but federal rules and regulations as well (in particular, Section 106 of the National Historic Preservation Act). Collectively, these tasks represent a cultural resource management approach that must be adopted by the contracting agencies as a condition for use of federal project water.

I: Identifying Historic Properties

A. The contracting agencies and the relevant county, where appropriate, shall complete a Class I literature search and a Class III field survey in the area of potential effect for a specific undertaking, except that a Class III survey will not be required when:

   1. The California Historical Resources Information System and State Historical Preservation Office (SHPO) agree that previous cultural resources surveys have already adequately identified historic properties, or

   2. The California Historical Resources Information System and SHPO agree that previous disturbance has eliminated the possibility of identifying historic properties.

B. An undertaking shall be considered to exist and an area of potential effect shall be defined when:

   1. The contracting agencies or the relevant county, directly or through the issuance of appropriate permits, undertake construction of new facilities to use contracted water. The area of potential effect will be the area affected by construction of new facilities from the point of diversion to the water treatment facility;

   2. The contracting agencies or the relevant county, directly or through the issuance of appropriate permits, contract with or allow individuals and corporations to construct new facilities and/or when new uses of contracted water are proposed. The area of potential effect will be the area affected by construction of the water delivery system and developments within the land areas that use contracted water.

C. Where the contracting agencies or the relevant county conduct an intensive (Class III) inventory, the SHPO's comments are not required prior to execution of the water delivery contract under the following conditions:

1. If no cultural resources (buildings, structures, sites, districts, or objects) are found within the area of potential effect.

2. If cultural resources are present within the area of potential effect, but potential effects are avoided through project redesign or project cancellation.

D. The contracting agencies or the relevant county shall submit inventory reports to the SHPO within 90 days after completion of the inventory, and the project may proceed before the SHPO's comments are issued if stipulation C. 1, above, applies. If the SHPO has questions or comments regarding the reports submitted within this framework, these comments will be provided to the state lead agencies for CEQA compliance, who shall address the SHPO's comments.

II: Assessing Effects

A. If the contracting agencies or the relevant county determine that proposed activities required to deliver, store, or treat contracted water would result in unavoidable effects to historic properties within the area of potential effect, then the contracting agencies or the county shall determine the effects in accordance with 36 CFR Part 800.5.

III. Treating Effects (Mitigation Measures)

A. The contracting agencies or the relevant County shall have the following options for treating effects to historic properties:

1. Avoid effects, as defined above, through redesign of the project;

2. Avoid effects by not executing the proposed contract;

3. Mitigate effects through measures such as data recovery or archival documentation. The contracting agencies or the relevant county, in consultation with SHPO, the Advisory Council on Historic Preservation, and other interested persons, shall work together to find measures to mitigate the effects of a particular undertaking on historic properties. The contracting agencies or the relevant county shall develop plans to implement the agreed upon mitigating measures and shall submit such plans to the SHPO, the

Advisory Council on Historic Preservation, and interested persons for review and comment. Unless SHPO or the Advisory Council on Historic Preservation object within 30 days of receipt of the plans, the contracting agencies or the relevant county shall ensure that these plans are implemented.

B. The contracting agencies or the relevant county shall ensure that any mitigation measures agreed on during consultation will be included as a specification in proposed developments involving water delivered under the proposed renewed service contract. Mitigation measures will be completed before the start of ground-disturbing activities that would affect the physical integrity of an historic resource. Mitigation measures for visual, audible, or atmospheric effects to cultural resources will be completed before water is delivered to the contractor.

IV: Properties Discovered During the Implementation of an Undertaking

A. If a previously undiscovered historic property is inadvertently encountered during construction or other similar activity, all work in the immediate vicinity of the property except that necessary to secure and protect the property will cease until the contracting agencies or the relevant county can secure assistance from a professional archaeologist who will be commissioned to evaluate and, if necessary, mitigate effects to the discovery. Evaluation and mitigation will be carried out in consultation with the SHPO and the Advisory Council on Historic Preservation as expeditiously as possible pursuant to 36 CFR Part 800.11(b)(2)(ii).

B. If human remains are discovered during data recovery or any construction activities, work in the immediate vicinity of the discovery will cease except to secure and protect the remains. The contracting agencies or the relevant county will immediately notify the SHPO to determine appropriate procedures for consultation and treatment of the human remains. The contracting agencies or the relevant County shall ensure that any human remains and grave-associated artifacts discovered are dealt with in accordance with California Statutes, their chapters and sections, which include: Chapter 1492, Statutes of 21982, Section 7050.5 of the Health and Safety Code, and Sections 5097.94, 5097.98, and 5097.99 of the Public Resources Code. In the event of such a contingency, the County Coroner, the Native American Heritage Commission, and a professional archaeologist would have to be informed and consulted, per State law. The goal of consultation would be to establish an agreement among the Native American representative, the archaeologist, the county, and the project proponent with regard to the proper treatment and disposition of any human remains and associated artifacts. Such treatment and disposition may require archaeological excavation and reburial.

Completion of specific water development projects in conformity with Tasks I through IV will, in most cases, ensure that important archaeological and historic resources are inventoried, assessed, and treated in conformity with all county general plans and other policies that have been adopted by the contracting agencies and the various counties within which the contracting agencies operate. However, the contracting agencies and the various counties will also consider specific developments, especially construction of new water delivery systems, in conjunction with any relevant county or municipal cultural resource protection plans and policies.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Class III inventories, as recommended above, are designed to ensure that all eligible and potentially eligible sites are identified, adequately evaluated in relation to NRHP eligibility criteria, and fully assessed in relation to project impacts. Such inventories are followed by preparation of detailed Historic Properties Treatment Plans, which take into consideration site significance and project effects. As a consequence, implementation of treatments recommended in these plans results in reducing to less-than-adverse levels the impacts that a project might have on an important or significant archaeological or historic site. By definition, reducing impacts to less-than-adverse levels implies that there would be no irreversible or irretrievable commitments of cultural resources. In other words, it is expected that treatment commensurate with the importance of an identified cultural property in relation to project effects would be undertaken prior to affecting the resource.

EFFECTS NOT FOUND TO BE SIGNIFICANT

To date, numerous archaeological and historic sites have been documented within the districts comprising the Delta-Mendota Canal Unit. For many of these, all required consultation regarding NRHP eligibility and project effects have been completed, resulting in the determination that some of these sites are not eligible for the NRHP or significant per CEQA. For these sites, the effects of water service contract renewal would not be considered significant or adverse, and no mitigation measures or other treatment or consideration would be necessary.

SECTION 4.12: RECREATIONAL RESOURCES

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on the recreational resources within the Delta-Mendota Canal Unit. Information in this section is summarized from the Draft PEIS, Recreation, Technical Appendix, Volume 4 (Reclamation, 1997c).

AFFECTED ENVIRONMENT

Recreation sites that could be affected by the renewal of long-term water service contracts include San Luis Reservoir, the O'Neill Forebay, the San Joaquin River, and wildlife refuges located near the Delta-Mendota Canal Unit. The Delta-Mendota Canal does provide limited recreational opportunities and, therefore, is treated as a potentially affected recreational area.

RESERVOIRS

San Luis Reservoir and the adjacent O'Neill Forebay provide reservoir-related recreational resources in the vicinity of the project area. The reservoirs are located west of Interstate 5 near State Route 152. They are within the San Luis Reservoir State Recreation Area, operated by the California Department of Parks and Recreation.

San Luis Reservoir

When it is full, San Luis Reservoir covers approximately 12,700 surface acres. Recreational activities include boating, water-skiing, fishing, picnicking, camping, hunting, and hiking. Reservoir facilities consist of one campground and two concrete boat ramps and boarding docks. The reservoir has no designated swimming or lakeside beach areas. Boat and shore fishing occur throughout San Luis Reservoir. Migratory waterfowl hunting is permitted on most of the reservoir. Hunting for deer and wild pig is also allowed on the northwest shoreline of the San Luis Reservoir State Recreation Area.

An estimated 210,000 twelve-hour recreation visitor days were reported in 1992 for the San Luis Reservoir. Water-enhanced activities account for the largest portion of reservoir use. Relaxing and camping are the most popular of the water-related activities. Seventy-seven percent of annual use occurs between April and September. The majority of visitors are from the Bay-Delta (38 percent) and San Joaquin Valley areas (27 percent) (DWR, 1987).

Recreation at the reservoir is optimized at a pool elevation 544 feet above mean sea level. Use of the two boat ramps becomes impaired between 340 and 360 feet above mean sea level. Swimming activities are unaffected by reservoir surface water fluctuations because the reservoir has no designated swimming facilities.

O'Neill Forebay

The O'Neill Forebay, immediately east of San Luis Reservoir, covers about 2,700 surface acres when full and was developed in part to accommodate recreational use that may be lost when San Luis Reservoir is drawn down. Recreational facilities consist of two boat ramps, two picnic areas, a campground, and a swimming area. Forebay recreational features also include the Medeiros recreation area, which provides picnicking, camping, and boat ramp access, and the San Luis Creek day-use area, which provides picnicking, swimming, and boat ramp access. Facilities accommodate boating, fishing, swimming, wading, camping, and sightseeing. In addition, the O'Neill Forebay is nationally known for windsurfing.

The O'Neill Forebay received approximately twice the recreation visitor days (417,000) as San Luis Reservoir in 1992. Recreational facilities at O'Neill Forebay provide more diverse recreational opportunities than those at San Luis Reservoir. The most popular activities are swimming, wading and relaxing. The majority of visits occur between April and September. Visitor origins include San Luis Reservoir, including coastal and bay counties to the west, and valley and foothill counties to the east.

Recreational use at O'Neill Forebay is generally not affected by water level fluctuations because pool elevations are usually maintained at constant levels. However, minor drops in surface elevation may affect beach use because a relatively large amount of the shoreline would be exposed.

SAN JOAQUIN RIVER

The San Joaquin River is approximately 100 miles long and extends from Millerton Lake to the Sacramento-San Joaquin Delta. Table 4.12-1 lists some of the recreational facilities and activities located on the San Joaquin River near the Delta-Mendota Canal Unit.

Recreational use estimates for the 100 miles of the lower San Joaquin River are not available. However, based on information provided by recreation sites on the river, boating and fishing activities are estimated to total about 157,000 six-hour recreation visitor days (California Department of Recreation and Parks, 1990). Most of the San Joaquin River visitors are assumed to originate from nearby counties.

Table 4.12-1
San Joaquin River Recreational Facilities and Activities near the Delta-Mendota Canal Unit

San Joaquin River Locations	Facilities and Activities
Millerton Lake to Merced County line near State Route152	No major public recreation features; public access at several road and state highway crossings
Merced County	San Luis National Wildlife Refuge Fremont Ford State Recreation Area
Stanislaus County	Las Palmas fishing access site Laird County Park Numerous public access points
San Joaquin County	Durham Ferry State Recreation Area Mossdale Landing County Park Dos Reis County Park Numerous public road crossings

Recreational use on the San Joaquin River has been substantially affected by operation of Millerton Lake and diversions from the Merced and Chowchilla Canals east of the Mendota Pool. The San Joaquin River flow is somewhat intermittent downstream of the Mendota Pool to the Merced River confluence, with flows fed mainly be irrigation return flows.

DELTA-MENDOTA CANAL

Fishing access to the Delta-Mendota Canal is provided at Delta-Mendota Canal Site 2A in Stanislaus County and Delta-Mendota Canal Site 5 in Fresno County. Both sites provide parking areas and restrooms (Reclamation, 1992b). Fishing access to the Delta-Mendota Canal is limited to the developed access points (Reclamation, 1993). Fishing is the only recreational activity allowed at both access sites.

Fishing use at the two sites was estimated at 23,000 visitor-days (Reclamation, 1997c). Canal Site 5 accounted for approximately 99 percent of this total in 1991. An estimated 85 percent of the visitors to the fishing sites originate in the local area (Reclamation, 1981). Because no water-contact activities are allowed on the canal, fluctuations in the water level or flow do not directly affect recreational opportunities.

WILDLIFE REFUGES

Recreational activities at national wildlife refuges and wildlife management areas could be affected by the CVPIA (Reclamation and Service, 1999). Wildlife refuges in the vicinity of the Delta-Mendota Canal service area include the San Luis and Kesterson National Wildlife Refuges; the Mendota, Volta, Los Banos, and North Grasslands (Salt Slough and China Island) Wildlife Management Areas; Action Plan Lands (Freitis and West Bear Creek); and the Grassland Resource Conservation District.

Recreation facilities on the national wildlife refuges and wildlife management areas are primarily designed to enhance wildlife observation activities. Recreational facilities are limited at the San Luis and Merced National Wildlife Refuges; however, both provide self-guided driving tours (Service, 1992). Camping is permitted at staging areas on the national wildlife refuges during hunting season only (Service, 1991). Camping is not allowed on the Volta or Los Banos Wildlife Management Areas.

Most recreational activities are wildlife-dependent. They include non-consumptive uses (e.g., wildlife observation) or consumptive uses (e.g., hunting). In 1992, combined recreational use at the refuges, including the Merced National Wildlife Refuge, was estimated to total approximately 56,000 five-hour recreational visitor-days (Reclamation, 1997c). Most visitation occurs during the winter when waterfowl are present.

About 15 percent of the visitors originate from the local area. Recreational activities at the refuges are associated with the presence of wildlife, primarily waterfowl. Visitation peaks in winter when waterfowl are present. Management regulations designed to minimize wildlife disturbance at the refuges include limiting public access to certain time periods and not providing facilities that would extend recreation beyond existing boundaries/limits for observation purposes.

PRIVATE HUNTING CLUBS

The 176 private waterfowl hunting clubs in the San Joaquin River Region cover about 96,800 acres. About 33,900 acres are flooded annually. Waterfowl hunting activity was estimated at 241,000 hunter-days in 1992.

ENVIRONMENTAL CONSEQUENCES

Impacts to recreational resources would be considered adverse if they result in a decline in the quality or quantity of existing recreational facilities or services, exceed adopted state or local recreation planning standards, or involve the installation of new facilities that could adversely impact the recreational environment.

NO-ACTION ALTERNATIVE

San Luis Reservoir could be affected by water level fluctuations during one or more dry or wet years. Boating would be constrained and shoreline activities would decline for two or more peak-season months as compared to the Affected Environment. During consecutive wet years, boat ramps would be unusable for one more peak-season month, boating would be constrained, and shoreline activities would decline for two more peak-season months and one more off-season month. Additional use could decrease about 1 percent during dry years and about 4 percent during wet years.

Because pool elevations in O'Neill Forebay are maintained at constant levels, water level fluctuations would not be affected. Increased stream flows on the San Joaquin River could increase recreational opportunities. Recreational opportunities provided by the Delta-Mendota Canal are expected to be similar to No-Action Alternative conditions because water level in the canal is held at a constant level. Wildlife refuges will receive increased water supplies as a result of Level 2 refuge water supplies, thereby maintaining existing refuge recreational opportunities at current or enhanced levels, especially for wildlife observation activities.

ALTERNATIVE 1

Similar to the discussion above for the No-Action Alternative, Alternative 1 would not result in adverse impacts on recreational resources. The facilities would continue to operate as in the past. Recreational opportunities and annual use levels at the O'Neill Forebay, San Joaquin River, Delta-Mendota Canal, and wildlife refuges are not expected to change from current conditions as a result of the long-term contract renewal.

ALTERNATIVE 2

Similar to the discussion above for the No-Action Alternative, Alternative 2 would not result in adverse impacts on recreational resources. The facilities would continue to operate as in the past. Recreational opportunities and annual use levels at the O'Neill Forebay, San Joaquin River, Delta-Mendota Canal, and wildlife refuges are not expected to change from current conditions as a result of the long-term contract renewal.

CUMULATIVE IMPACTS

Cumulative impacts on a CVP-wide basis are addressed in the CVPIA PEIS. Beyond those cumulative impacts, there are no additional impacts attributable to Alternative 1 or 2 that would contribute to cumulative recreational impacts.

SECTION 4.13: VISUAL RESOURCES

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on the visual resources in the Delta-Mendota Canal Unit. Information in this section is summarized from the Draft PEIS, Visual Resources, Technical Appendix, Volume 6 (Reclamation, 1997e).

AFFECTED ENVIRONMENT

The San Joaquin River Region is lowland with predominantly flat and gently sloping terrain bordered by hills and low mountains. The valley is semi-arid to arid, and few natural lakes of perennial streams are present. The San Joaquin River is the principal water feature. A number of wetlands used as wildlife refuges are located in the region. The valley area is developed predominantly for agriculture. It is sparsely to moderately populated, having one large urban area (metropolitan Fresno) and scattered small communities. The northern area of the region near the city of Tracy is developing rapidly.

CVP facilities in the vicinity of the Delta-Mendota Canal Unit include the San Luis Reservoir and O'Neill Forebay. The reservoirs are within a state recreation area. The landscape in this area is considered common scenic to minimal scenic quality.

The area surrounding the Delta-Mendota Canal is predominantly of minimal scenic quality, with some areas of common scenic quality (U.S. Forest Service, 1976). Interstate 5 provides panoramic view opportunities in some of the Delta-Mendota Canal Unit, some segments of which are designated scenic highways. Views of the Delta-Mendota Canal and California Aqueduct are the basis for the designation of Interstate 5 as a scenic highway. Similarly, views of San Luis Reservoir are important reasons for State Route 152 being designated a scenic highway.

Wildlife refuges in the region near the Delta-Mendota Canal Unit project area are considered to have landscape variety that ranges from common scenic to distinctive scenic quality (U.S. Forest Service, 1976). These areas provide visual contrast with surrounding agricultural lands primarily because of their vegetation and water. The scenic quality is enhanced seasonally by the large numbers and variety of waterfowl and seasonal wildflower displays, which attract substantial visitation, thereby increasing the viewer sensitivity of the area.

ENVIRONMENTAL CONSEQUENCES

A visual resource impact would be considered adverse if it interfered with existing scenic views, blocked visibility, or produced light and glare inconsistent with existing areas. Impacts in the Delta-Mendota Canal Unit project area are dependent on (1) changes in cropping patterns, which may result in increased fallowed land and the associated modified agricultural viewshed, and (2) releases from storage reservoirs, which may result in a "bathtub ring" effect caused by the appearance of unvegetated soil at the shoreline between the water surface and the high water line.

NO-ACTION ALTERNATIVE

Under the No-Action Alternative, irrigated acreage would be reduced by only a small amount (see Section 4.2, Agriculture). The visual character of lands irrigated in the past for agricultural purposes would not be substantially altered. Because of the combined use of surface and groundwater, the general cultivated and fallowed acreage patterns would be similar to historical patterns, and agricultural viewsheds would not substantially change. Neither scenic views nor visibility would be adversely impacted. Therefore, the No-Action Alternative would not adversely impact visual resources.

If San Luis Reservoir is operated to increase end-of-month storage in September, the occurrence of the present "bathtub ring" effect would be reduced as compared to the Affected Environment, particularly during the summer months when the reservoir experiences substantial use.

ALTERNATIVE 1

Similar to the discussion above for the No Action Alternative, Alternative 1 would not result in adverse impacts on visual resources. General cultivated and fallowed acreage patterns would be similar to historical patterns, and agricultural viewsheds would not change. Neither scenic views nor visibility would be adversely impacted.

ALTERNATIVE 2

Similar to the discussion above for the No Action Alternative, Alternative 2 would not result in adverse impacts on visual resources. General cultivated and fallowed acreage patterns would be similar to historical patterns, and agricultural viewsheds would not change. Neither scenic views nor visibility would be adversely impacted.

CUMULATIVE IMPACTS

Cumulative impacts on a CVP-wide basis are addressed in the CVPIA PEIS. Beyond those cumulative impacts, there are no additional impacts attributable to Alternative 1 or 2 that would contribute to cumulative visual impacts.

SECTION 4.14: PUBLIC HEALTH/MOSQUITOES

This section discusses the potential effects that the alternatives considered in Chapter 2 would have on public health/mosquitoes within the Delta-Mendota Canal Unit. Information in this section was summarized primarily from the Final PEIS (Reclamation and Service, 1999).

AFFECTED ENVIRONMENT

As discussed in the PEIS, in addition to being persistent pests, mosquitoes can carry various strains of diseases known as arboviruses (or, more specifically, encephalitis). They are also known to transmit malaria (a parasitic blood disease) to humans and heartworms (a parasite) to dogs. Because the viruses often go unreported until patients develop acute symptoms, the prevalence of the viruses is also subsequently underreported. According to the PEIS, outbreaks have been reported in the San Joaquin Region.

Any environment in which water is allowed to stand in shallow areas can serve as breeding ground for mosquitoes. These environments include wetlands, wildlife refuges, pastures, streams, canals, reservoirs, and other areas where water is relatively still. The main features near the project area that carry water include the San Joaquin River, Delta-Mendota Canal, and Mendota Pool. Some of these features could provide breeding grounds for mosquitoes. Also, sloughs and wildlife refuges that are near the project area typically serve as mosquito breeding grounds.

The majority of the 20 contractors in the Delta-Mendota Canal Unit have distribution systems to transport their CVP water supply. These distribution systems generally consist of varying lengths of lined and unlined canals, lift stations, underground pipelines, and open ditches. Much of these systems are gravity-fed, open canals. Also, as discussed in Chapter 4, many of the contractors within the Delta-Mendota Canal Unit reuse drainage or tailwater to eliminate offsite drainage. This tailwater is most often transported through unlined ditches either directly back onto a field for irrigation or into a district's distribution system for reuse.

Local mosquito control agencies have been developed to control mosquitoes and other vectors in an effort to control epidemics of human encephalitis and malaria. The mosquito abatement districts and control agencies adapt their practices in response to hydrologic conditions and the extent of areas supporting appropriate breeding habitat (Reclamation and Service, 1999).

ENVIRONMENTAL CONSEQUENCES

The major project features either within or near the project area with the greatest likelihood of attracting mosquito populations include the San Joaquin River and the Mendota Pool. A higher potential for breeding would occur in standing water near the San Joaquin River, which is a natural channel, and the Mendota Pool, which serves a reservoir. It is expected that mosquito breeding would be less along the Delta-Mendota Canal because the water typically flows swiftly as it is distributed throughout the Central Valley. Open canals and ditches associated with contractors' distribution systems and reuse of tailwater could provide breeding ground for mosquitoes.

NO-ACTION ALTERNATIVE

As described in Chapter 2, the No-Action Alternative provides baseline conditions for comparing the action alternatives and represents future conditions at a projected level of development without the implementation of any action alternative.

The implementation of the No-Action Alternative is not expected to increase flows or the incidence of standing water in project features and, therefore, would not result in an increase in mosquito populations above those already in existence. Because no direct increase in mosquito populations is anticipated, it is assumed that CVP contractors will continue to implement existing local vector abatement programs to control mosquito breeding conditions and protect public health. One practice that would continue is the removal of aquatic weeds from open ditches and canals. Areas with heavy aquatic weed growth can contribute to creating an environment attractive to mosquitoes. The majority of the 20 contractors remove aquatic weeds by applying a chemical herbicide. Other contractors use mechanical practices to remove weeds from canals.

The implementation of tiered pricing under this alternative could result in contractors seeking alternative, more affordable water supply sources. As a result, groundwater pumping and water transfers could increase. Increased groundwater pumping is not expected to directly contribute to an increase in the mosquito population, because the facilities used to pump and distribute groundwater are primarily underground and would not result in standing water.

Increased water transfers are also not expected to directly contribute to an increase in the mosquito population. It is assumed that no additional distribution facilities or expansions of any existing facilities would be constructed as a result of long-term contract renewals. It can be assumed that water will be transferred through the existing distribution facilities and will not expand the existing mosquito population.

As the quantities of CVP water deliveries are decreased, the environment contributing to mosquito breeding will also correspondingly decrease to the extent that standing water is decreased.

ALTERNATIVE 1

Similar to the discussion above for the No Action Alternative, Alternative 1 would not directly result in an increase in mosquito populations or have an adverse impact on public health. The implementation of Alternative 1 is not expected to increase flows or the incidence of standing water in project features and, therefore, would not result in an increase in mosquito populations above those already in existence.

ALTERNATIVE 2

Similar to the discussion above for the No Action Alternative, Alternative 2 would not directly result in an increase in mosquito populations or have an adverse impact on public health. The implementation of Alternative 2 is not expected to increase flows or the incidence of standing water in project features and, therefore, would not result in an increase in mosquito populations above those already in existence.

CUMULATIVE IMPACTS

Cumulative impacts on a CVP-wide basis are addressed in the CVPIA PEIS. Beyond those cumulative impacts, there are no additional impacts attributable to Alternative 1 or 2 that would contribute to cumulative public health impacts.